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PREDICTION OF SCHOLASTIC SUCCESS IN COLLEGES OF LAW: I. THE EXPERIMENTAL EDITION OF THE IOWA LEGAL APTITUDE TEST[1]

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THE COUNSELING of students concerning the advisability of their undertaking courses leading to a professional degree is one of the most difficult problems confronting college personnel workers and deans of professional colleges. Since successful completion of a long, difficult and expensive course of study is a *sine qua non* of admission to practically every profession, it is obvious that the determination of the student's capacity for scholastic success should be one of the primary concerns of the counselor. If the potential failure can be identified and apprised of his meager chances for satisfactory achievement prior to his enrollment in the professional school, he may enter some other vocational field where he may be more successful. Conversely, if the student possessing superior capacity for professional studies can be so informed, he may be stimulated to make the sacrifices requisite for entrance on a professional career. It would seem axiomatic, therefore, that every improvement in our ability to determine individual capacity for success in a given professional curriculum should redound to the benefit of the individual student, the professional colleges, and society as a whole.

[1] First of two parts of a condensation of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Psychology, in the Graduate College of the State University of Iowa, July, 1942. The second part will appear in the next issue of this journal.

[2] The writer is deeply indebted to Dr. Dewey B. Stuit, Department of Psychology, and Dean Mason Ladd and Dr. Lehan K. Tunks, College of Law, University of Iowa, for generous aid and advice and to the faculties of the eight colleges of law who cooperated in the aptitude test experiment.

TABLE 1

Summary of the Principal Findings of Research in the Field of Law Prognosis

Reference	Index studied	Criterion	College of law	N	r
Crawford (2)	Thorndike CAVD Test*	First-year law grades*	Yale University	...*	.45†
Crawford (2)	Chapman Legal Aptitude Test*	First-year law grades*	Yale University	...*	.40†
Crawford (2)	Total pre-law grades*	First-year law grades*	Yale University	...*	.50†
Crawford (2)	Combined Thorndike CAVD Test, Chapman Test, and pre-law grades for Yale undergraduates	First-year law grades*	Yale University	...*	.72*
Crawford (2)	Combined Thorndike CAVD Test, Chapman Test, and pre-law grades for non-Yale undergraduates	First-year law grades*	Yale University	...*	.60*
Crawford (2)	Yale Legal Aptitude Test for all students	First-year law grades for 1931	Yale University	103	.64
Crawford (2)	Combined Yale Legal Aptitude Test and pre-law grades for all students	First-year law grades for 1931	Yale University	99	.78
Crawford & Gorham (3)	Equated junior year pre-law grades for all students	First-year law grades for 1931 to 1937	Yale University	749	.55
Crawford & Gorham (3)	Yale Legal Aptitude Test for all students	First-year law grades for 1931 to 1937	Yale University	749	.51
Crawford & Gorham (3)	Combined Yale Legal Aptitude Test and equated junior year pre-law grades for all students	First-year law grades for 1931 to 1937	Yale University	749	.64
Crawford & Gorham (3)	Junior year pre-law grades for Yale undergraduates	First-year law grades for 1938	Yale University	30	.60
Crawford & Gorham (3)	Yale Legal Aptitude Test for Yale undergraduates	First-year law grades for 1938	Yale University	30	.62
Crawford & Gorham (3)	Combined Yale Legal Aptitude Test and junior year pre-law grades for Yale undergraduates	First-year law grades for 1938	Yale University	30	.73
Crawford & Gorham (3)	Equated junior year pre-law grades for all students	First-year law grades for 1938	Yale University	118	.34

* More adequate description of experimental group not available in original article.
† Average of several correlations obtained with different experimental groups.
‡ Correlation computed from data presented in original article.

TABLE 1—(*Continued*)

* More adequate description of experimental group not available in original article.
† Average of several correlations obtained with different experimental groups.
‡ Correlation computed from data presented in original article.

TABLE 1—(*Continued*)

Reference	Index studied	Criterion	College of law	N	r
Crawford & Gorham (3)	Yale Legal Aptitude Test for all students	First-year law grades for 1938	Yale University	118	.55
Crawford & Gorham (3)	Combined Yale Legal Aptitude Test and equated junior year pre-law grades for all students	First-year law grades for 1938	Yale University	118	.55
Crawford & Gorham (3)	Combined Yale Legal Aptitude Test and equated junior year pre-law grades for all students	Second-year law grades for the class of 1940	Yale University	105	.58
Crawford & Gorham (3)	Combined Yale Legal Aptitude Test and equated junior year pre-law grades for all students	Third-year law grades for the class of 1939	Yale University	125	.60
Crawford & Gorham (3)	Combined Yale Legal Aptitude Test and equated junior year pre-law grades for all students	Cumulative average of grades for three years of law school for the class of 1939	Yale University	125	.59
Eagleton (4)	Ferson-Stoddard Law Aptitude Examination for all students	First-year law grades for 1930	University of Chicago	117	.49
Eagleton (4)	ACE Psychological Examination for all students	First-year law grades for 1930	University of Chicago	117	.56
Eagleton (4)	Combined ACE and Ferson-Stoddard Law Aptitude Examination for all students	First-year law grades for 1930	University of Chicago	117	.62
Harrell (7)	Total pre-law grades for Univ. of Illinois undergraduates	First-semester law grades for 1935 to 1937	University of Illinois	235	.75
Harrell (7)	Ferson-Stoddard Law Aptitude Examination for Univ. of Illinois undergraduates	First-semester law grades for 1935 to 1937	University of Illinois	235	.46
Harrell (7)	Combined Ferson-Stoddard Law Aptitude Examination and pre-law grades for Univ. of Illinois undergraduates	First-semester law grades for 1935 to 1937	University of Illinois	235	.78
Husband (10)	ACE Psychological Examination for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.39

* More adequate description of experimental group not available in original article.
† Average of several correlations obtained with different experimental groups.
‡ Correlation computed from data presented in original article.

TABLE 1—(*Continued*)

Reference		Index studied	Criterion	College of law	N	r
Husband	(10)	Yale Legal Aptitude Test for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.39
Husband	(10)	Total pre-law grades for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.53
Husband	(10)	Combined ACE, Yale Legal Aptitude Test and total pre-law grades for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.57
Husband	(10)	Av. pre-law grades in social sciences for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.52
Husband	(10)	Av. pre-law grades in natural sciences for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.53
Husband	(10)	Av. pre-law grades in languages for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.44
Husband	(10)	Av. pre-law grades in major field for all students	Average grades in the three-year law course for 1933–1935	University of Wisconsin	125	.52
Jacobs	(11)	Total pre-law grades for Columbia University undergraduates	First-year law grades for 1931 to 1934	Columbia University	165	.57
Jacobs	(11)	Av. pre-law grades in social sciences for Columbia University undergraduates	First-year law grades for 1931 to 1934	Columbia University	165	.62
Jacobs	(11)	Av. pre-law grades in natural sciences for Columbia University undergraduates	First-year law grades for 1931 to 1934	Columbia University	165	.52
Jacobs	(11)	Av. pre-law grades in the humanities for Columbia University undergraduates	First-year law grades for 1931 to 1934	Columbia University	165	.43
Kandel	(12)	Columbia University Law School Test*	First-year law grades*	Columbia University	...*	.38*
Kandel	(12)	Total pre-law grades for all students	First-year law grades from 1928 to 1936	Columbia University	2031	.41
Kidd	(13)	Total pre-law grades*	First-year law grades*	University of California	...*	.50†

* More adequate description of experimental group not available in original article.
† Average of several correlations obtained with different experimental groups.
‡ Correlation computed from data presented in original article.

TABLE 1—(*Continued*)

* More adequate description of experimental group not available in original article.
† Average of several correlations obtained with different experimental groups.
‡ Correlation computed from data presented in original article.

TABLE 1—(*Continued*)

Reference		Index studied	Criterion	College of law	N	r
Kidd	(13)	California Legal Aptitude Test*	First-year law grades for three years*	University of California	...*	.60†
Kidd	(13)	Combined California Legal Aptitude Test and pre-law grades*	First-year law grades for three years*	University of California	...*	.70†
Prosser	(16)	Total pre-law grades*	First-year law grades*	University of Minnesota	...*	.49†
Prosser	(16)	University of Minnesota Test in Law*	First-year law grades*	University of Minnesota	...*	.62†
Prosser	(16)	Combined Minnesota Test in Law and pre-law grades*	First-year law grades*	University of Minnesota	...*	.64†
Riker & Gaudet	(17)	Ferson-Stoddard Law Aptitude Examination for all students	First-year law grades for 1928 and 1929	New Jersey Law School	246	.42
Riker & Gaudet	(17)	Ferson-Stoddard Law Aptitude Examination*	First-year law grades*	University of Newark	180	.34
Riker & Gaudet	(17)	Dearborn Group Test*	First-year law grades*	University of Newark	180	.20
Riker & Gaudet	(17)	Otis Self-Administering Test of Mental Ability, Form D*	First-year law grades*	University of Newark	180	.26
Stoddard	(19)	1st Ed. of Ferson-Stoddard Law Aptitude Examination for all students	First-semester law grades for 1926	University of Iowa	100	.55
Stoddard	(19)	1st Ed. of Ferson-Stoddard Law Aptitude Examination for all students	First-year law grades for 1926	University of Iowa	100	.54
Tracy	(20)	University of Michigan Legal Aptitude Test for all students	First-year law grades for 1940	University of Michigan	203	.60
Welker & Harrell	(21)	Pre-law grades for all students	First-semester law grades for 1938 and 1939	University of Illinois	133	.49
Witham	(22)	Ferson-Stoddard Law Aptitude Examination for all students	First-year law grades for 1927 to 1929	University of Tennessee	64	.54‡
Wood	(23)	Av. pre-law grades for Columbia University undergraduates	First-year law grades for 1922	Columbia University	50	.47

* More adequate description of experimental group not available in original article.
† Average of several correlations obtained with different experimental groups.
‡ Correlation computed from data presented in original article.

Inspection of Table 1, a tabular summary of the principal findings of research in the field of law prognosis, reveals that pre-law grades, standardized group tests of general intelligence, and specially constructed tests of so-called "legal aptitude" have been most widely investigated in studies involving the prediction of scholastic success in law. Of these indices, specialized tests of "legal aptitude" appear to constitute the most promising single index of capacity for successful law school achievement. Unfortunately, the most valid tests of this latter type cannot be made available for use outside the individual colleges of law for which they were developed. As a first step in a research program directed at providing improved methods of law prognosis it seemed desirable, therefore, to initiate experimentation on a new test of scholastic aptitude for legal studies which would incorporate the best features of existing tests of this type, and which could be made available for general use by schools of law and college personnel counselors.

A careful examination of the relevant literature, supplemented by consultation with members of the faculty of the College of Law of the University of Iowa, revealed rather general agreement among authorities that certain more or less well defined intellectual characteristics are especially essential to the study of law. Bingham (1), Crawford (2), Ferson (5), Gulliver (6), Stoddard (19) and others agree fairly well that the most important of these capacities are: (1) ability to read difficult material rapidly and with comprehension, (2) ability to memorize quickly and to recall with accuracy, (3) ability to reason by analogy, (4) ability to discriminate between the relevant and irrelevant in a mass of facts, (5) skill in inductive and deductive reasoning, and (6) verbal facility, including a large available vocabulary and ability to learn new words readily. Although it is to be hoped that future research in the field of factor analysis will yield a more precise delimitation of the primary mental abilities requisite to legal studies, it was decided that these six types of ability would be accepted as the principal ones to be measured in the experimental test battery.

After a critical evaluation of the types of items which had proved most promising in other tests of legal aptitude, the

writer, in collaboration with Dean Mason Ladd and Dr. Lehan K. Tunks of the College of Law of the University of Iowa, prepared a tentative battery of eight tests, each of which seemed to measure one or more of the mental functions in which we were interested. In order to provide an optimum basis for successful revision, it seemed advisable to allow extremely liberal time limits and to include approximately twice as many items in the trial battery as would be retained in the final edition. The 1941 experimental edition, therefore, consisted of eight parts comprising a total of 455 items and requiring 260 minutes of actual testing time. Because of its length, the test was published in two parts to be administered in separate sessions. The following sub-tests were included:

Part 1. *Analogies.* The examinee was requested to select, from a group of six words, two which bore the same relationship to each other as two key words. This test was similar to those commonly employed in group tests of general intelligence, but was scaled at a somewhat higher level of difficulty. The test was designed to measure the student's verbal facility and ability to reason by analogy. 75 items. 45 minutes.

Part 2. *Mixed Relations.* The examinee was asked to select, from a group of six words, the three which were most closely related in some way. This test, again, was considerably more difficult than the analogous type commonly used in tests of general intelligence. The intention here was to evaluate the student's vocabulary and ability to reason inductively in determining basic relationships. 80 items. 35 minutes.

Part 3. *Opposites.* The examinee was required to select, from a group of five alternative, a word opposite in meaning to a given key word. This test differed from the usual test of verbal opposites in that ability to recognize specific parts of speech as well as word knowledge was required. The purpose was to measure precision in the use of English and general vocabulary. 80 items. 35 minutes.

Part 4. *Memory* Prior to taking Part 1, the student was allowed eight minutes to study a rather detailed judicial opinion. Approximately two hours later, after completing Part 3, he was given twelve minutes to answer multiple-choice questions over the significant facts without being permitted to refer back to the case. This was primarily a test of reading comprehension and ability to memorize and to recall with accuracy. 30 items. 20 minutes.

Part 5. *Relevancy.* A somewhat involved case of a legal nature was presented for study. Certain hypothetical principles of law were then stated. The student was directed to indicate whether each principle would be relevant to the argument of the plaintiff, the defendant, or to neither party in the suit. This test involved com-

prehension of difficult reading material, ability to recognize crucial points in a mass of facts, and ability to discriminate between the relevant and irrelevant. 50 items. 45 minutes.

Part 6. *Reading Comprehension.* This test was adapted directly from Part 2 of the *Ferson-Stoddard Law Aptitude Examination.* After reading a judicial opinion, the student was required to answer questions concerning what he had read, to indicate the analogous points in a second hypothetical case, and to determine the relevancy of certain facts in the original opinion to the hypothetical case. Reading comprehension, ability to reason by analogy, and ability to discriminate between the relevant and irrelevant were involved. 40 items. 20 minutes.

Part 7. *Reasoning.* The examinee was required to accept a stated premise as true and to indicate whether a given conclusion was necessarily true, probably true, necessarily false, probably false, or indeterminate. The primary purpose of this test was to evaluate skill in inductive and deductive reasoning. 40 items. 40 minutes.

Part 8. *Information.* This sub-test consisted of true-false questions concerning common facts of law which, it was believed, students with special interest in legal matters might be more apt to acquire and retain, through incidental reading and introductory courses in history and political science, than would students whose interests were less specifically focused on legal topics. 60 items. 20 minutes.

The experimental edition of the test was administered at the beginning of the fall term of 1941 to all entering first-year students in eight different colleges of law.[3] Although the operation of the Selective Service Act and other factors contingent on the war had decreased the normal freshman enrollment in most of these schools by over fifty per cent, complete test data were secured for a total of 250 cases.

All tests were returned to the writer for scoring. In computing the raw score for each sub-test, the customary correction for chance success was made for each part with the exception of Parts 1 and 2, in which the chances of guessing successfully seemed too small to justify such a correction. The raw scores on each sub-test were then multiplied by the reciprocal of the standard deviation of the distribution for that part in order to give each sub-test approximately equal weight, and the resulting weighted part scores were summated for each examinee.

[3] University of Cincinnati, Creighton University, Drake University, University of Indiana, University of Iowa, Ohio State University, University of Pittsburgh, and University of Tennessee. To preserve their anonymity in the body of the article, these colleges will henceforth be referred to by randomly assigned letters.

The mean, standard deviation, median, and range of the distributions of total weighted raw scores for the group tested in each cooperating college of law are presented in Table 2.

TABLE 2

Performance of Freshman Students in Different Colleges of Law on the Experimental Edition of the Iowa Legal Aptitude Test

College of law	N	M*	S.D.*	Mdn*	Range*
College A	35	247.46	40.89	240.00	179–333
College B	17	232.59	73.67	250.00	103–361
College C	52	229.31	55.05	219.50	90–363
College D	17	223.59	34.05	233.00	167–282
College E	54	227.89	62.26	220.50	101–400
College F	15	217.20	43.60	219.00	138–331
College G	19	212.16	60.19	217.00	51–356
College H	41	229.54	68.99	235.00	10–341
Composite (eight colleges)	250	229.38	58.32	226.67	10–400

* Based on total of weighted part scores.

These data indicate that the various groups differed rather markedly in level and range of ability with respect to the composite of intellectual functions measured by the total test battery.

The intercorrelations between the unweighted raw scores on the eight sub-tests comprising the total test battery, and the correlation between the raw scores on each sub-test and the total raw score on the battery, based on the experimental group of 250 cases, are presented in Table 3. Application of the z-function test of significance suggested by Lindquist (15) indi-

TABLE 3

*Intercorrelations of the Total and Sub-Test Unweighted Raw Scores on the Experimental Edition of the Iowa Legal Aptitude Test**

	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	Part 7	Part 8
Part 1								
Part 2	.823							
Part 3	.806	.850						
Part 4	.463	.404	.366					
Part 5	.446	.455	.410	.457				
Part 6	.459	.438	.387	.437	.470			
Part 7	.528	.480	.481	.301	.409	.464		
Part 8	.469	.420	.377	.416	.406	.451	.353	
Total	.883	.870	.852	.570	.633	.621	.641	.616

* Based on 250 cases in eight colleges of law.

cates that the intercorrelations between the eight sub-tests are all significant at better than the 1 per cent level of confidence. The relatively high intercorrelations between Parts 1, 2, and 3 suggest that these three sub-tests are more highly saturated with some common factor or factors than are the other sub-tests of the battery. Inspection of the individual items reveals that the single factor most unique to these three tests is one of word knowledge or verbal facility. The other sub-tests are probably all measuring reading comprehension to a greater or less degree in addition to more specific mental characteristics which they were designed to appraise.

Originally, a rigorous revision of the experimental battery by the method of maximizing functions developed by Horst (8) had been contemplated. However, because of the small number of cases in each experimental group for whom measures of relative law school achievement were finally available, it was necessary to postpone this study. Consequently, only an analysis of the internal consistency and relative difficulty of the items, in preparation for a first revision, was made at this time.

In order to obtain a tentative estimate of the relative reliabilities of the various sub-tests of the experimental battery for comparison with the reliabilities obtained with subsequent revisions of the test, the reliability of each of the sub-tests and of the test as a whole was estimated by the formula given as Case IV by Kuder and Richardson (14). The values obtained for Parts 1 to 8 of the test battery, based on 250 cases, were .89, .89, .94, .77, .73, .74, .83, and .84, respectively, while the reliability of the total test was .97.

The first study of the predictive value of the experimental test battery was made at the end of the first semester of the 1941–42 academic year. In order that the criterion measures might be as nearly comparable as possible from school to school, the following procedure was utilized. In each of the three colleges which had expressed willingness to assist in this portion of the study, the instructor of each freshman law course ranked the members of his class in order of their relative achievement during the first semester. The ranks thus assigned were converted into linear scores by the method sug-

gested by Hull (9), weighted by the number of hours credit allowed for each course, and the resulting weighted linear scores summated for each student and divided by the total number of hours credit earned. The students in each school were then reranked on the basis of these mean weighted linear scores and the ranks again converted into linear scores by means of Hull's method. Thus the final criterion of first-semester law school achievement consisted of a single linear score for each examinee based upon the composite ratings of his instructors in all the freshman law courses which he had taken during the first half of the academic year.

The validity coefficients obtained by correlating the criterion measures for the students in each college of law with the total of the weighted sub-test scores received on the experimental test battery are presented in Table 4. When the re-

TABLE 4

Correlations between Measures of First-Semester Law School Achievement and Performance on the Experimental Edition of the Iowa Legal Aptitude Test

College of law	N	r	M*	S.D.*	Range*
College A	29	.42	246.28	43.01	179–333
College C	42	.67	227.52	54.50	90–363
College H	39	.77	226.00	68.59	10–341

* Based on total of weighted part scores.

liabilities of the validity coefficients for the three separate criterion groups were tested by the z-function, it was found that we may be confident, at the 1 per cent level, that the true validity lies between .53 and .90 for College H, between .38 and .84 for College C, and between – .05 and .74 for College A. In terms of this rigorous criterion of significance, the only individual coefficient which can confidently be considered highly encouraging is that obtained with the group of freshman law students in College H.

In order to obtain a more reliable estimate of the validity of the experimental battery, the possibility of combining the three separate criterion groups into a single composite criterion was examined. Computation of the critical ratios of the differences between the means of the total weighted sub-test scores

for the three groups revealed no statistically significant differences between these groups insofar as this measure was concerned. However, a critical ratio of 2.66, significant at the 1 per cent level of confidence, was found between the standard deviations of the College A and College H groups. We were not, therefore, justified in assuming that all three groups were drawn at random from identical normal populations insofar as performance on the aptitude test battery was concerned. Nevertheless, since no statistically significant differences had been found between the means of the test scores for the three groups, the inclusion of the highly homogeneous College A group in the composite criterion would, according to the logic of correlation theory, tend to attenuate the validity coefficient and thus yield an underestimate of the true validity. It seemed feasible, therefore, to combine all three groups. The coefficients of correlation between the sub-test scores and the criterion measures, the total test scores and the criterion, and the intercorrelations between the sub-test scores for this composite criterion group are presented in Table 5.

TABLE 5

*Intercorrelations between Measures of First-Semester Law School Achievement and Part and Total Scores on the Experimental Edition of the Iowa Legal Aptitude Test**

	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	Part 7	Part 8	Total score
Part 1									
Part 2	.798								
Part 3	.807	.837							
Part 4	.521	.435	.448						
Part 5	.369	.384	.326	.408					
Part 6	.544	.516	.491	.527	.480				
Part 7	.528	.439	.469	.418	.440	.618			
Part 8	.471	.476	.441	.403	.393	.572	.466		
Criterion ...	.552	.513	.573	.401	.360	.456	.571	.462	.647

* Based on 110 cases in three colleges of law.

The z-function test of significance indicates that we may be confident, at the 1 per cent level, that the true correlation between the total of the weighted sub-test scores and the criterion lies between .49 and .77 for the composite group of 110 cases upon which the values in Table 5 were based. Application of the

Wherry-Doolittle test selection technique (18) yielded a maximum multiple correlation of .67 between the criterion measures and an optimally weighted combination of the scores on three of the sub-tests for this combined group. The sub-tests selected for inclusion in the final battery were Part 3, which correlated .573 with the criterion; Part 7, which increased the multiple correlation to .664; and Part 8, which further increased the multiple correlation to the final value of .672. Insofar as this particular criterion group was concerned, the addition of other sub-tests of the experimental battery added more chance error than validity to the selected test battery.

A further check on the tentative validity of the experimental test battery was made at the end of the 1941–42 academic year. In each of four colleges of law, the remaining freshman students were ranked in order of achievement in each course which they had completed during the year and, by the procedure previously described, the ranks were normalized, weighted, combined, averaged, and converted to final linear criterion scores. In a fifth college, College A, it was impossible to obtain the final ranks in individual courses; but a single numerical grade, representing the weighted average of the numerical grades in all courses completed, was available for each student. It was, therefore, necessary to compute the final linear score for the students in this criterion group by ranking them on the basis of their average numerical grades and converting the ranks to linear scores by Hull's method. Although the criterion measures thus obtained for this group were perhaps slightly less reliable, they were, for the purpose of this preliminary study, comparable in all important respects to the measures computed for the other four colleges of law.

The validity coefficients obtained by correlating the criterion scores, representing first-year law school achievement for the students in each of the five colleges of law, with the total of the weighted sub-test scores received on the law aptitude test are given in Table 6.

With the exception of the correlation for College B, which is significant at only the 5 per cent level, the validity coefficients presented in Table 6 are all significant at the 1 per cent

level of confidence. However, the reliabilities of the individual coefficients are so low that little confidence can be placed in their absolute values. The *z*-function test, applied to the four most significant coefficients, indicates that we may be confident, at the 1 per cent level, only that the true correlation lies between .45 and .90 for College H, between .44 and .86 for College C, between .40 and .85 for College E, and between .02 and .77 for College A.

When the total pre-law grade-point averages for the 42 students in College C, which yielded a correlation of .56 with the criterion of first-year law school achievement, was combined with the legal aptitude test scores for this group, a multiple correlation of .77 with the criterion was obtained. Although this coefficient, like those obtained in other portions of this study, must be considered as tentative, it does serve to suggest the predictive efficiency which may eventually be attained by further experimentation with combinations of pre-law grade-point averages, scores on a perfected test of legal aptitude and, possibly, other predictive indices.

TABLE 6

Correlations between Measures of First-Year Law School Achievement and Performance on the Experimental Edition of the Iowa Legal Aptitude Test

College of law	N	r	M*	S.D.*	Range*
College A	29	.48	248.55	43.17	179–333
College B	12	.64	246.67	74.35	121–361
College C	42	.71	228.58	55.17	90–363
College E	40	.69	232.00	65.14	101–400
College H	28	.76	234.79	70.65	10–341

* Based on total of weighted part scores.

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THE FACTORIAL REPRESENTATION OF MENTAL ABILITY AND ACADEMIC ACHIEVEMENT

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IT IS well known that an appreciable correlation exists between intelligence tests and scholastic achievement as measured by achievement examinations or as indicated by teachers' grades. Some have inferred from this correlation that a causal relationship exists between "intelligence" and school success, or that at any rate general intelligence tests are the best devices for the prediction of scholastic success. With recent developments in the factor analysis of intelligence tests it becomes possible to investigate anew the relationship between mental ability and educational achievement with the aim of depicting more clearly the nature and structure of this relationship. This has been the chief aim of the present study.

A substantial amount of evidence has accumulated to support the hypothesis that detailed and specific relationships exist between certain types of mental ability tests and success in different courses of study. In one of the earliest studies of the predictive validity of factors of mental ability, Chein (4) attempted to find whether upper and lower criterion groups in various academic studies could be differentiated on the basis of performance in verbal, numerical, and spatial tests. The verbal tests were found to be most satisfactory for this purpose. Ellison and Edgerton (7) in an investigation of Thurstone's *Primary Mental Abilities Tests* present correlations between factor scores and grades in English, science, foreign language, and psychology. These correlations suggest that there may be differences among these four studies with respect to their relationships to the several primary mental ability factors. Craw-

ford (6) has also presented data which may be interpreted as indicating that the *Primary Mental Abilities Tests* may have some value for differential diagnosis, although Crawford himself is skeptical of this possibility.

Burt (2) has published a factor analysis of scholastic achievement tests themselves. The common factors found in these tests are described as a general factor, a verbal factor, a manual factor, and an arithmetical factor. Since Burt did not include in his battery any of the usual tests of intelligence or of group factors of ability, no conclusion can be drawn from the study as to the relationship between ability factors and educational achievement. Nor is there any guarantee that the general factor isolated in Burt's study overlaps with the general factor "*g*" described by Spearman, since Burt's general factor may be only a general factor of scholastic achievement. The evidence provided in Alexander's study (1) is more relevant for our problem, since the correlational matrix analyzed included not only measures of success in certain school subjects but also tests of various abilities. Alexander was able to identify a general factor common to both ability tests and achievement data, a verbal factor related to success in English, mathematics, and science, and a "practical ability" factor which entered into excellence in shop work. The latter factor is perhaps congruent with the spatial factor studied by the Thurstone school. Alexander also found a factor "*X*" which was specific and common to the measures of achievement; he suggests a relation between this factor and Webb's character factor *w*. Holzinger and Swineford (8) have performed a factor analysis on a battery somewhat similar to Alexander's. Besides a general factor common to all measures in the battery, spatial, verbal, speed, and memory factors were found to be differentially related to grades in various school subjects. Common to the achievement measures alone was a factor interpreted as a "halo" factor resulting from the teachers' general opinions of the pupils apart from scholastic achievement. These writers conclude, "On the whole, school marks are a function of general ability (probably deductive) and verbal ability, together with their common factor (halo) and their

unique factors." One other factorial study of ability and achievement measures is Sisk's (12), but the writer feels that on account of an inadequate handling of the factor analysis this study does not further our understanding.

The central purpose of the present investigation has been to provide a further description of the relationships between mental ability and scholastic achievement. It is believed that the recently developed multiple-factor techniques of Thurstone with their emphasis on simple structure and the correlations between linearly independent factors are appropriate for this purpose. A battery of measures was planned to include various indicators of academic achievement together with tests of several mental ability factors selected as most probably important in the types of school achievement studied. The battery was also designed to suggest answers to several subsidiary problems, each of which will be discussed below.

The factors of ability measured in the battery were: the verbal factor usually labeled *V*, the rote learning factor *M*, and a reasoning factor variously labeled as *R* or *D*. The factorial composition of many of the tests had been investigated in a previous study by the writer (3), which attempted to identify the factors in various types of verbal tests. The tests taken from this study which were expected to tap the verbal factor were as follows: *Grammar* [13],[1] *Verbal Analogies* [14], *Word Choice* [15], *Disarranged Morphemes* [17], and *Phrase Completion* [18]. In addition, Thurstone's *Verbal Completion* test [22], the *Mount Holyoke Reading Test* [26], the verbal score from the *Scholastic Aptitude Test* of the College Entrance Examination Board [28], and the *Mount Holyoke Vocabulary Test* [29] were included as probable measures of the verbal factor. It was of interest to see whether tests 13 to 18 would cluster as they had in the previous study and whether the additional tests would behave in the expected manner.

As measures of the "reasoning" factor three tests from the writer's previous study were included, namely: *Verbal Analo-*

[1] The bracketed numbers following names of tests are code numbers by which the tests are identified in the tables. The tests are briefly described in order in a later paragraph.

gies [14], *Disarranged Morphemes* [17], and *Morpheme Recognition* [20]. The writer was anxious to find out whether these tests would be found to be related to the factor *D* of Thurstone's studies (15); consequently, two tests of *D* were used, namely, Thurstone's *Verbal Completion* test [22], and *Reasoning II* [23]. The writer's hypothesis regarding all these tests was that in common they involve an element of *serial reasoning* wherein by logical inference, deduction, and similar processes the subject arrives at a conclusion after taking several steps in the reasoning process. The test score is regarded as largely a function of speed in executing these steps, but undoubtedly level of difficulty is sometimes a factor. It seems reasonable to suppose that individual differences in such a reasoning factor would be reflected in academic achievement.

Tests of the rote learning factor usually identified as *M* were included in the battery for two reasons. First, it was thought that a relation might be found to exist between the ability to learn simple associations and the acquisition of knowledge in school. Such a relation is suggested by Ellison and Edgerton's report (7) of significant correlations between the score on factor *M* of the *Primary Mental Abilities Tests* and grades in English and foreign language. Secondly, the inclusion of tests of *M* in a factorial test battery facilitates the rotation to simple structure because of the great independence of these tests. The tests used in the present study, *Word-Number* [16] and *Paired Associates* [19], have been found to be good reference tests of factor *M*.

The measures of scholastic achievement were as follows: Final grades in college freshman English composition [24]; Academic average for the college freshman year [25]; and four subtests of an objective final examination in elementary psychology: true-false items [30], multiple-choice items [31], analogies items [32], and single-word completion items [33]. The number of achievement variables was restricted to those listed here because of practical considerations, but it was believed that the use of these few measures would lead to a satisfactory answer to the problem of depicting relationships between mental ability and achievement. It was realized that

some of the correlations among these measures would be spuriously raised through part-whole relationships, but it was believed that the factorial techniques to be utilized would be adequate to untangle these relationships. Of almost primary interest was the question as to whether the subtests of the objective examination in psychology would show differential correlations with the three factors of ability selected. It seemed reasonable to postulate that objective examinations covering knowledge of a verbal nature might be related to the verbal factor and that achievement items cast in the form of analogies might be related to the reasoning factor presumably measured by the *Verbal Analogies* test. These suppositions receive a modicum of support from certain studies purporting to show that tests tend to cluster according to the form of the test item (13).

Allied with the problem of the relationship between cognitive factors and indices of scholastic achievement is the general problem of the prediction of scholastic achievement, for the latter problem can be successfully investigated only with a knowledge of the former. We have therefore included in the battery several tests which are samples of those often used as devices for the prediction of scholastic success. Many of the tests already mentioned fall in this classification, but the following are of special importance: Verbal score of the *Scholastic Aptitude Test* [28], *Minnesota Speed of Reading Test* [27], the *Mount Holyoke Vocabulary Test* [29], and the *Mount Holyoke Reading Test* [26].

It was thought that light might be shed on the analysis of factors related to school achievement by the inclusion in the battery of other types of achievement tests. Scores on the *Cooperative Contemporary Affairs Test* (1941 Edition) happened to be available for the experimental population. If analysis were to reveal a factor common to both the *Cooperative Contemporary Affairs Test* and the measures of scholastic achievement, we might be able to infer, for example, that acquisition of knowledge is a general trait covering not only knowledge acquired in formal schooling, but also information learned incidentally. The *Contemporary Affairs Test* con-

tained six subtests, as follows: *Political Events* [34], *Social and Economic Events* [35], *Science and Medicine* [36], *Literature* [37], *Fine Arts* [38], and *Amusements* [39]. The writer had made for pedagogical purposes a factor analysis of the correlations of the subtests of the corresponding 1940 examination as reported by Ryans (11). This factor analysis revealed two chief group factors in the test, one represented mainly by the first two subtests, the other represented by the

TABLE 1

A Multiple Factor Analysis of the Subtests of the 1940 Cooperative Contemporary Affairs Test

Subtest		Correlations reported by Ryans (11)				
		1	2	3	4	5
Political Events	1					
Social Events	2	.711				
Sci. & Medicine	3	.455	.486			
Literature	4	.467	.469	.390		
Fine Arts	5	.469	.459	.418	.565	
Amusements	6	.425	.379	.320	.471	.592

Centroid matrix

	I	II	III	h^2
1	.767	.300	.197	.717
2	.762	.350	.068	.708
3	.605	.142	−.221	.435
4	.694	−.180	−.120	.528
5	.733	−.306	−.028	.632
6	.659	−.328	.156	.566

Transformation matrix

	A	B	C
I	.22	.32	.17
II	.64	−.89	−.07
III	.74	.31	−.98

Rotated matrix

	A	B	C
1	.51	.04	−.09
2	.44	−.05	.04
3	.06	.00	.31
4	−.05	.34	.25
5	−.06	.50	.18
6	.05	.55	−.02

Cosines of angular separations of the reference vectors

	A	B	C
A	1.00	−.27	−.73
B	−.27	1.00	−.18
C	−.73	−.18	1.00

Correlations between the primary factors

	A	B	C
A	1.000	.598	.822
B	.598	1.000	.572
C	.822	.572	1.000

Interpretations of the factors

Factor A: Knowledge of political and social events.
Factor B: Knowledge of the fine arts, literature, and amusements.
Factor C: No interpretation.

last two subtests. These two factors were found to be correlated to the extent of .598. It was of interest to see whether similar results would be yielded by the inclusion of the test in a larger battery. For purposes of comparison, the chief data of the earlier factor analysis are reported here (Table 1).

For convenience we now give brief descriptions of each of the test variables in order. The length of the tests and the time limits are stated in the parentheses.

Grammar [13] requires the subject to alter sentences, when necessary, to conform to the standards of English usage taught in school. (50 items; 9 min.)

Verbal Analogies [14] is a test where the subject responds by choosing which of five alternatives is the appropriate completion of a simple analogy. Sample item: foot: shoe:: hand: (1. thumb; 2. head; 3. glove; 4. finger; 5. clasp). (56 items; 6 min.)

Word-Choice [15] requires the subject to show that he knows the distinctions between the meanings of certain pairs of words which are similar in spelling, such as *continuously* and *continually*. (34 items; 8 min.)

In *Word-Number Memory* [16] the subject learns and recalls simple associations of words and numbers. (20 pairs; 5 min. for learning, 3 min. for recall.)

In *Disarranged Morphemes* [17], each item consists of a number of syllables which are to be rearranged to form an adjective and a noun. Example: *-s quire ex ing re act ment* to form *exacting requirements*. (37 items; 8 min.)

Phrase Completion [18], the construction of which has been described by the writer (3), consists of a number of incomplete phrases such as "As for _____" which the subject must complete with the first word that comes to mind. The scoring is based upon the community of response. (24 items; work-limit.)

Paired Associates [19] is a test requiring the subject to learn and recall a short English-Turkish vocabulary. (24 pairs; 4 min. learning, 4 min. recall.)

Morpheme Recognition [20] requires the subject to give the meanings of Latin roots and affixes found in English deriva-

tives. He is aided in recognizing the correct answers by certain examples of derivative words. (30 items; 15 min.)

Verbal Completion [22] is a test, frequently used by Thurstone, which appears to measure recall vocabulary. Sample item: A person licensed to practice medicine is a (d)_____. (50) items; 7 min.)

Reasoning II [23] has been used by Thurstone (15). The subject must make certain inferences from the statements made in the test. Sample item: My brother writes: "I have walked over from Byford Wood today, where I had the misfortune to break a limb." Can you guess from this which limb he probably broke? (15 items; 7 min.)

English Composition Final Grades [24] were obtained from college records. The grades are based on themes passed in during two semesters and on a final examination requiring the student to write an essay utilizing source material which is presented on the examination paper.

The *First-Year College Average* [25] is a composite of the student's grades in academic subjects.

The *Mount Holyoke Reading Test* [26], constructed by H. Moore, is used by the college to diagnose reading difficulties. It consists of the following subtests: 1. *Paragraph Meaning:* A. *Prose,* B. *Poetry;* 2. *Vocabulary;* 3. *Central Meanings;* 4. *Proverbs;* 5. *Symbols;* 6. *Headings;* 7. *Rate of Reading.* The total score was used. (Total time-limit: 25½ min.)

The *Minnesota Speed of Reading Test* [27] requires the subject to read short paragraphs as fast as possible and to indicate progress by underlining absurd phrases interspersed in the paragraphs. (36 paragraphs; 6 min.)

Variable [28] was the verbal score of the *Scholastic Aptitude Test* published by the College Entrance Examination Board. The subtests on which the verbal scores are based include same-opposites, analogies, and other types of verbal tests. Most of the subjects took this test in 1940.

The *Mount Holyoke Vocabulary Test* [29] is a vocabulary test of the usual multiple-choice type.

The *Final Examination in Psychology* was prepared by the writer in cooperation with the instructors of the course. It con-

sisted of four parts, true-false [30], multiple choice [31], analogies [32], and completion [33], and covered the content of the second semester of a year course in elementary psychology. The topics studied in the course were represented in the items proportionately to the emphasis placed on them, and the four parts of the examination were designed to be homogeneous with respect to the sampling of subject-matter. Two hours were allowed for the examination, all students being enabled to finish their work.

The *Cooperative Contemporary Affairs Test* (1941 Edition) is a multiple-choice achievement test covering the student's knowledge of contemporary events in six areas, as follows:

Political Events [34]—60 items; 20 min.
Social and Economic Events [35]—60 items; 20 min.
Science and Medicine [36]—30 items; 10 min.
Literature [37]—45 items; 15 min.
Fine Arts [38]—45 items; 15 min.
Amusements [39]—60 items; 20 min. This section covers such things as drama, motion pictures, and sports.

A battery composed of tests 13 to 23 was administered in two one-hour sessions to the elementary psychology classes at Mount Holyoke College in the spring of 1941. The scores for variables 24 to 29 and 34 to 39 were made available to the writer from administrative records. The objective psychology examination (variables 30 to 33) was administered as the final examination in the course. The records were found to be complete for 88 freshman women and these individuals constituted the experimental population. It is believed that the present study successfully escapes criticism of the sort made by Kelley (9) and others with regard to factorial investigations using populations not homogeneous with respect to sex.

Reliability coefficients of the tests, with certain exceptions, were not computed, since in many cases they were already known from previous studies and since factorial structure is

TABLE 2

*The Correlational Matrix**

	13	14	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
13																									
14	415																								
15	105	154																							
16	125	−158	110																						
17	414	486	221	156																					
18	259	184	−019	074	275																				
19	179	130	092	406	274	209																			
20	437	526	234	041	330	109	268																		
22	458	543	216	083	430	313	289	525																	
23	349	474	100	−045	323	133	132	277	507																
24	309	114	118	042	189	085	146	327	319	318															
25	251	086	147	135	096	028	195	350	344	261	767														
26	419	386	−001	085	406	299	275	377	499	312	194	239													
27	397	359	102	100	351	175	176	276	415	349	182	185	404												
28	387	543	253	041	487	337	285	500	652	421	388	403	524	454											
29	264	381	229	085	417	234	300	439	557	312	317	329	562	335	776										
30	310	226	173	−003	194	098	122	315	324	354	402	575	423	237	345	364									
31	169	167	074	022	263	126	105	244	379	286	440	624	366	232	348	415	765								
32	241	074	121	147	120	080	104	287	202	180	436	507	339	136	251	289	585	560							
33	157	017	070	111	180	186	123	185	279	215	448	600	340	148	246	349	716	789	605						
34	−017	086	102	018	130	010	122	099	406	158	116	117	159	089	268	308	056	133	014	029					
35	−061	133	201	−025	207	001	241	150	435	171	143	084	086	028	278	296	022	109	−030	027	768				
36	098	135	−046	029	143	−052	207	123	223	146	198	195	092	177	162	185	095	087	102	106	424	280			
37	152	261	142	157	270	−025	288	275	306	246	162	141	181	242	371	372	095	111	057	066	490	508	361		
38	120	211	128	−139	173	028	156	138	237	105	177	155	269	091	447	414	108	029	016	−013	367	363	232	468	
39	−130	119	−010	029	071	−023	140	125	238	146	−022	−014	234	184	260	318	−026	−012	−069	−032	378	434	178	544	554

* All entries have been multiplied by 1000 in order to eliminate the decimal point.

not essentially affected by the reliabilities of the tests. Theoretically, the reliability of a test will exceed or equal its communality (h^2). Since it was of interest to compare the reliabilities of the subtests of the objective examination in psychology, these values were estimated, as follows:

Subtest	*Odd-Even Reliabilities Raised by the Prophecy Formula*
True-false	.676
Multiple choice	.728
Analogies	.464
Completion	.894

The correlation matrix (Table 2) was obtained by punched card methods. For convenience, the test scores were in each case coded into ten or fewer class intervals. All computations were fully checked. The correlations were not corrected for

TABLE 3

*The Centroid Matrix**

Test	I	II	III	IV	V	VI	VII	VIII	IX	X	h^2
13	485	−112	411	−110	−077	−222	−232	−107	−139	−055	590
14	511	273	366	188	−326	−135	−188	141	−068	158	714
15	253	090	052	−161	−217	207	230	170	−161	−032	299
16	157	−105	142	−438	378	127	129	189	152	−141	502
17	549	111	337	−040	056	086	−145	057	−084	215	517
18	268	−066	320	119	157	140	−031	−215	068	073	294
19	416	058	149	−313	323	078	095	034	084	038	426
20	579	043	227	−115	−280	−128	102	103	−121	−028	533
22	761	151	207	048	−161	136	−111	−158	136	−209	791
23	522	042	120	131	−229	−066	−217	079	203	−075	463
24	548	−356	−188	−218	−241	−240	103	−222	167	100	723
25	586	−485	−269	−166	−238	−161	196	−104	240	037	869
26	622	−077	230	269	223	−068	−032	−060	−202	−130	635
27	486	040	268	073	053	−163	−165	058	147	−117	410
28	790	164	222	187	−053	−035	255	−164	033	129	849
29	745	109	078	189	092	059	280	−076	−070	076	716
30	592	−516	−124	200	−155	068	−069	199	−126	−026	762
31	590	−527	−211	222	−072	234	−096	130	044	120	822
32	461	−540	−108	−043	−028	−042	037	086	−172	−078	565
33	522	−639	−225	151	068	203	−049	109	063	090	826
34	433	424	−459	−108	044	215	−199	−259	−051	−167	775
35	435	507	−428	−155	−049	369	−071	−110	−029	−087	818
36	333	187	−272	−163	117	−146	−230	−047	048	114	352
37	525	434	−275	−143	164	−139	−018	242	028	028	667
38	417	373	−276	148	080	−209	214	−133	−170	110	566
39	323	467	−299	242	296	−167	159	163	072	−199	683

* The entries have been multiplied by 1000.

grouping or attenuation, nor was there any attempt to correct spuriously high correlations such as that between variables 24 and 25.

In finding the centroid matrix (Table 3), Thurstone's method was used (14). After ten factors had been extracted,

TABLE 4

The Transformation Matrix

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*
I	.32	.25	.22	.36	.12	.20	.14	.18	.19	.03
II	.11	.26	−.02	−.70	−.20	.26	.21	−.03	.13	.24
III	.57	.34	.32	−.46	−.19	−.13	−.36	.12	.20	−.12
IV	.36	.11	−.58	.25	−.37	.49	−.21	−.19	−.07	.04
V	.09	−.33	.61	−.02	−.22	.35	−.11	.20	−.50	−.02
VI	.16	−.23	.16	.10	−.59	−.42	.53	−.51	.38	.04
VII	−.01	−.42	.10	−.09	.21	.52	−.45	−.48	.48	−.07
VIII	−.56	.41	.20	.27	−.51	.22	−.41	−.06	.22	.02
IX	.07	.38	.22	.09	.18	−.07	−.02	−.62	−.46	.08
X	.27	−.32	−.05	.10	.16	−.15	−.33	.07	.03	.95

the residuals appeared to be small enough to make further analysis unnecessary. According to McNemar's criterion (10), five factors were found to be significant, but even the extraction of ten factors did not meet Coombs' criterion (5). The writer feels that the final results of the analysis justify the belief that about six or seven factors are actually significant. It is possible that McNemar's criterion is trustworthy for determining the number of uncorrelated factors, but it does not seem to apply in the case of correlated factors.

The arbitrary axes of Table 3 were rotated to a structure

TABLE 5

Cosines of Angular Separations between the Reference Vectors

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*
A	.99									
B	−.01	1.01								
C	.01	.00	.99							
D	−.24	−.09	−.14	1.00						
E	.00	−.20	−.09	.00	.99					
F	−.01	.00	−.05	.01	−.05	1.01				
G	.01	−.02	−.06	−.03	−.11	−.51	1.01			
H	.00	.03	.03	−.09	.16	−.03	−.05	1.01		
J	.03	−.08	−.11	−.11	−.22	.00	−.05	−.18	.98	
K	.24	−.21	−.10	.03	.09	−.10	−.18	.00	.00	.99

which for the most part is a simple structure. The transformation matrix, the matrix of cosines of the angular separations between reference vectors, and the rotated factorial matrix are presented in Tables 4, 5, and 6. In certain cases pairs of primary planes were rotated to simple structure and then set uncorrelated with each other. This was true for the pairs of factors *A–B* and *D–E*. The reasons for carrying out such

TABLE 6

*Rotated Factorial Matrix**

Test		*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*
Grammar	13	33	31	15	−01	16	−10	−02	46	05	−13
Verbal Analogies	14	38	54	−12	−07	−08	07	−11	23	28	21
Word-Choice	15	−04	03	08	00	−09	00	04	−10	49	−02
Word-Number	16	−12	−02	68	00	−05	−03	−02	−03	−03	−18
Dis. Morphemes	17	41	22	27	01	−11	−03	−01	24	18	22
Phrase Completion	18	49	01	18	00	−05	−03	02	02	−02	03
Paired Associates	19	16	00	56	−03	03	05	02	08	03	03
Morph. Recog.	20	16	31	08	04	14	08	−08	18	38	−05
Verbal Completion	22	45	43	13	06	01	00	33	01	18	−14
Reasoning II	23	20	51	−03	19	01	01	09	04	02	−03
Eng. Comp. Grades	24	05	−01	01	42	63	−07	02	07	−01	04
College Average	25	−04	−02	03	60	57	−01	−01	−08	03	−03
Mt. Hol. Reading	26	41	14	13	18	−09	32	−05	30	06	−16
Minn. Spd. Reading	27	27	44	19	06	00	13	−04	17	−07	−10
Sch. Apt. Verbal	28	58	16	09	06	15	34	−09	01	29	15
Mt. Hol. Vocab.	29	44	02	13	16	03	39	−04	01	29	10
Psychol. T–F	30	00	10	−09	74	−03	03	−01	10	18	−11
" M–C	31	08	00	−04	82	−05	−05	08	−05	07	06
" Anal.	32	−08	−07	06	58	15	02	−04	18	11	−20
" Completion	33	03	−10	07	84	00	−04	03	−04	−02	00
Coop. C. A. Test:											
Polit. Events	34	02	00	−01	−01	01	−01	70	06	−02	02
Soc. & Econ.	35	−02	01	04	−04	−09	−02	67	−10	19	11
Sci. & Med.	36	−03	08	10	08	18	03	21	24	−21	20
Literature	37	−13	22	22	04	01	33	10	16	01	18
Fine Arts	38	13	−10	−12	−02	18	48	01	15	10	20
Amusements	39	−07	16	06	−02	−12	66	00	−04	−12	−04

* The entries have been multiplied by 100 to eliminate the decimal point.

rotations will be discussed in connection with the interpretations of the factors involved. The correlations between the primary factors, with the exception of factor *K*, are presented in Table 7, and a second-order centroid analysis of these correlations, omitting factors *H* and *J*, is shown in Table 8.

In interpreting the factors, we shall regard loadings of .30 or greater as significant.

TABLE 7

Correlations between the Primary Factors

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*
A	1.000								
B	.035	1.000							
C	.028	.068	1.000						
D	.242	.122	.174	1.000					
E	.011	.247	.160	.072	1.000				
F	.014	.056	.125	.048	.152	1.000			
G	.008	.082	.145	.080	.200	.529	1.000		
H	.020	−.026	.004	.110	−.109	.056	.068	1.000	
J	.010	.153	.176	.170	.262	.096	.144	.163	1.000

TABLE 8

*Second-Order Factor Analysis of Correlations between Primaries**

Centroid matrix

	I	II	III	h^2
A	213	212	−350	213
B	315	212	218	192
C	321	086	046	113
D	360	317	−259	297
E	400	118	358	302
F	534	−481	−030	517
G	578	−455	032	542

Transformation matrix

	I'	*II'*
I	899	438
II	438	−899

Rotated matrix

	I'	*II'*
A	284	−098
B	376	−053
C	251	064
D	463	−127
E	412	069
F	269	666
G	321	662

Third factor residuals

	A	*B*	*C*	*D*	*E*	*F*	*G*
A	−024	001	042	007	−026	−008	008
B	001	048	−061	002	018	003	−011
C	042	−061	056	−043	006	004	−003
D	007	002	−043	042	016	000	−024
E	−026	018	006	016	−019	−006	012
F	−008	003	004	000	−006	009	−002
G	008	−011	−003	−024	012	−002	022

* All entries have been multiplied by 1000 in order to eliminate the decimal point.

Inspection of its column in Table 6 reveals that factor *A* is represented by the following tests:

Code No.	*Test*	*Projection on A*
28	Scholastic Aptitude—Verbal	.58
18	Phrase Completion	.49
22	Thurstone Verbal Completion	.45
29	Mount Holyoke Vocabulary Test	.44
17	Disarranged Morphemes	.41
26	Mount Holyoke Reading Test	.41
14	Verbal Analogies	.38
13	Grammar	.33

It seems obvious that this factor can be identified as similar to Thurstone's factor *V* and to the factor *C* of the writer's previous study (3). Of the tests included in the battery to determine *V*, all except *Word-Choice* appear in the list above. The failure of *Word-Choice* to behave as expected may perhaps be explained as due to its being too difficult for the population studied. In any case, the interpretation of the factor as given previously by the writer is upheld: "The factor represents differences in the stock of linguistic responses possessed by the individual—the wealth of the individual's past experience and training in the English language." Every test in the foregoing list conforms to this interpretation. For convenience, we may designate this factor as a *verbal knowledge* factor. It is not necessarily identical with Thurstone's factor *V*, however.

Factor *B* is represented by the following tests:

Code No.	*Test*	*Projection on B*
14	Verbal Analogies	.54
23	Thurstone Reasoning II	.51
27	Minnesota Speed of Reading	.44
22	Thurstone Verbal Completion	.43
20	Morpheme Recognition	.31
13	Grammar	.31

This factor is apparently similar to factor *J* of the writer's previous study, since at least two tests from that study, *Verbal Analogies* and *Morpheme Recognition*, appear in this list. Furthermore, on account of the presence of tests 22 and 23 it seems probable that factor *B* is related to the factor *D* (Deductive Reasoning) of Thurstone's studies (15). Nevertheless, the appearance here of the *Minnesota Speed of Reading Test* suggests a possible modification of the current interpretation of this factor as a serial reasoning factor. The common element in the tests listed above may perhaps correspond to speed of reading rather than to facility in reasoning, for in each of the tests the score is certainly to some extent a function of speed of reading. Even if speed of reading is not the common element, some sort of speed of performance may be involved inasmuch as all the tests above are time-limit tests. On the other hand the form of the items in the *Minnesota Speed of*

Reading Test, in which the subject must underline an absurd phrase in each paragraph, suggests that facility in serial reasoning may affect the individual's standing in the test. The interpretation of factor *B* is thus indeterminate and awaits further investigation. For convenience, nevertheless, we shall refer to factor *B* as *Facility in Serial Reasoning.*

If the reader will plot the test projections on factor *B* with those on factor *A,* he will see that the writer has arbitrarily set the two reference vectors orthogonal to each other on the assumption that no pure tests of *B* are present in the battery. It would have been possible to rotate plane *B* to simple structure, producing an appreciable correlation between primaries *A* and *B.*

Only two tests, *Word-Number Memory* [16] and *Paired Associates* [19] have significant projections on factor *C.* The factor is undoubtedly congruent with the factor *M* (Rote Learning) of Thurstone's studies. It may be remarked that the loadings obtained here (test 16, .68 and test 19, .56) are somewhat higher than usual.

Factor *D* is represented by the following test variables:

Code No.	*Test*	*Projection on D*
33	Psychology examination: Completion items	.84
31	" " Multiple choice items	.82
30	" " True-false items	.74
32	" " Analogies items	.58
25	First-year college average	.60
24	English composition final grades	.42

It is evident that the common element in these variables is some sort of scholastic achievement. We must consider, however, the generality of the factor measured here. Inasmuch as variables 30 to 33 to some extent contribute to variable 24, perhaps factor *D* represents in part the spurious overlap between these variables. On the other hand, since the final grades in English composition were independent of the scores in the psychology examination, their intercorrelations and their common projections on factor *D* seem to indicate that a fairly general factor of scholastic achievement is present.

Factor *D* seems somewhat similar to the achievement factors found by Alexander (1) and by Holzinger and Swineford (8). Educators have often observed that excellence in educational performance seems to operate as a unitary variable somewhat independent of "general intelligence." The present factor *D* seems to confirm such an observation. For convenience we may refer to this factor as a *scholastic achievement* factor. Nevertheless, this factor does not seem to represent a halo effect in teachers' ratings inasmuch as the psychology examination was wholly objective. The possibility should not be ignored that factor *D* gives undue emphasis to knowledge of psychology. The correlations among variables 30 to 33 are in the neighborhood of 1.00 when corrected for attenuation, and it seems likely, therefore, that the primary vector *D* has been passed directly through variables 30, 31, 32, and 33.

Factor *D* has been rotated in such a way that it is orthogonal to factor *E;* if we had followed the requirements of simple structure we should have reduced the projections of variables 24 and 25 to the neighborhood of zero and left factors *D* and *E* markedly correlated. This rotational procedure, admittedly arbitrary, was followed in order to leave factor *D* uncorrelated with what was regarded as a spurious factor, factor *E*. The difficulties of rotation might perhaps have been avoided by constructing the test battery differently, had these results been anticipated.

Factor *E* is represented by the English composition final grades [24] and the first-year college average [25]. The projections of these variables are, respectively, .63 and .57. The writer believes the most likely interpretation of the factor is that it corresponds to the spurious overlap between variables 24 and 25, that is, to a specific factor in variable 24 which appears spuriously in variable 25. Whether this specific factor is attributable merely to unreliability of measurement or to a genuine trait affecting excellence in English composition we cannot tell. Further investigation of the relations between educational abilities may provide an answer to this question.

We may now consider two factors which are connected chiefly with the *Cooperative Contemporary Affairs Test.* We

shall present the significant projections on these two factors in the same table.

Code No.	*Test*	*Projections* F	G
39	Coop. Contemp. Affairs: Amusements	.66	.00
38	" " " Fine Arts	.48	.01
29	Mount Holyoke Vocabulary Test	.39	−.04
28	Scholastic Aptitude: Verbal Score	.34	−.09
37	Coop. Contemp. Affairs: Literature	.33	.10
26	Mount Holyoke Reading Test	.32	−.05
34	Coop. Contemp. Affairs: Political Events	−.01	.70
35	" " " Social & Econ. Events	−.02	.67
22	Thurstone Verbal Completion	.00	.33

The correlation between primary factors *F* and *G* is .529, which appears to indicate that a second-order common factor of some sort underlies all the tests in the table above. Such a factor might be identified as representing a general knowledge of contemporary affairs; it might be related to general culture and information. Factors *F* and *G* are subdimensions of this higher-order common factor. Individuals tend to differ primarily with respect to their general knowledge of contemporary events, but two types of specialization of knowledge (and possibly interest) are also distinguishable. Factor *F* seems to represent knowledge of contemporary affairs in the area of the fine arts, literature, and drama. We should expect the typical dilettante to obtain a high score in this factor. Factor *G* apparently represents knowledge of contemporary affairs in the field of politics, government, and economics.

We cannot explain the appearance of *Verbal Completion* among the tests of *G*. It is true that a few words in the test are of specific importance in the field of politics and economics. The presence of the three verbal tests 26, 28, and 29 on factor *F* perhaps indicates a relationship between verbal knowledge and acquaintance with contemporary literature and fine arts. In order to sketch a hypothesis concerning this relationship we must first recognize that there exist pure tests of verbal knowledge in the battery and that the correlation between primaries *A* and *F* is only .014. Hence it may be inferred that only a certain area of verbal knowledge is related to factor *F*. Evi-

dently the usual vocabulary test such as variable 29 tends to emphasize recondite words which are rarely found anywhere else but in literature. A person's score in such a vocabulary test is thus a function not only of his general verbal knowledge but also of the extent of his specialized experience with and interest in literature. This hypothesis implies that general verbal knowledge as represented by factor *A* does not necessarily include the knowledge of recondite words useful only in special situations. Hence, tests of *A* and their constituent items, in order to be pure measures, mut be uncorrelated with literary acquaintance. Such tests as *Phrase Completion* and *Verbal Analogies* seem to meet this requirement.

It may be noted that the subtests of the *Cooperative Contemporary Affairs Test* behave in the larger battery very much as they did in the smaller factor analysis shown in Table 1. A considerable degree of factorial invariance seems to have been attained by the methods employed.

Two of the remaining factors do not lend themselves to ready interpretation. These are: factor *H*, represented by *Word-Choice* and *Morpheme Recognition*, and factor *J*, represented only by *Grammar* and the *Mount Holyoke Reading Test*. In each case the presence of the common factor is apparent even from inspection of the original correlational matrix, but because of the meagerness of evidence no interpretation can be offered. These factors may, of course, be due to chance.

Factor *K* is a residual factor which represents nothing of psychological importance.

The second-order factor analysis presented in Table 8 may help to clarify the relationships among the more important primary factors. Three centroid factors were extracted from the matrix of correlations among seven factors in Table 7; two of the resulting axes were rotated orthogonally in such a way as to reduce the projections of factors *A*, *B*, *C*, *D*, and *E* to near zero on plane *II'*. This had the effect of approximately eqalizing the projections of all factors on plane *I'*. Second-order factor *I'* may perhaps be regarded as a general factor of some kind, while factor *II'* appears to represent a common factor underlying all the tests of factors *F* and *G*. We have suggested above

that such a factor corresponds to general knowledge of contemporary affairs. Plane *III* of the second-order centroid analysis was not rotated since it appeared that this could not be done in any meaningful way. It must be admitted that the procedures used in this second-order analysis were somewhat arbitrary, and the results are reproduced here only for whatever they may be worth to the technically trained reader. The results of a second-order factor analysis are directly dependent upon the rotational procedures employed in the first-order analysis. The possibility that our second-order factor I' represents a general factor similar to that described by Spearman merits consideration. Tucker (16) has suggested several hypotheses regarding the place of second-order common factors.

Having attempted to identify the various factors in the test battery we are in a position to suggest answers to some of the original problems of the investigation. Of primary interest was the light thrown by this study on the relation between mental ability and scholastic achievement. If we interpret factor *D* as scholastic achievement, the correlations (Table 7) between scholastic achievement and the mental abilities represented by factors *A* (verbal knowledge), *B* (serial reasoning), and *C* (rote learning) are, respectively, .242, .122, and .174. These correlations are lower than we would be led to expect by the frequent allegations regarding the relation between "intelligence" and scholastic achievement. They are also somewhat lower than we might expect on the basis of some of the original correlations. For example, in Table 2 we see that the Scholastic Aptitude Test [28] has a correlation of .403 with the first-year college average [25]. On the other hand, certain relatively pure tests of *A*, such as *Phrase Completion* and *Disarranged Morphemes*, have very low correlations with measures of achievement. The correlation between tests 28 and 25 thus gives a false impression of the relation between factors *A* and *D*, since it is weighted also with the correlation between *F* and *D* and perhaps also with correlated errors.

Scholastic achievement seems to be most closely associated with verbal knowledge, although as we have said the relationship is not very marked. We cannot precisely state, of course,

the nature of this relationship. On the assumption that factors *A* and *D* are truly correlated, three possibilities may be considered: (1) that verbal knowledge acquired independently of formal schooling aids scholastic achievement; (2) that scholastic achievement somehow facilitates and encourages the acquisition of verbal knowledge; and (3) that both verbal knowledge and scholastic achievement, insofar as they are correlated, are due to some sort of general capacity. Another possible interpretation of the relationship we have depicted is that scholastic achievement and verbal knowledge are in reality uncorrelated but that our measures of verbal knowledge are indirectly measures of scholastic achievement and *vice versa.* Factorial techniques cannot determine which of these possibilities is correct; it can only delineate the fundamental variables and their superficial relationships. Nevertheless, the results presented here should serve to emphasize that the relationship between mental ability and scholastic achievement is much more tenuous than intelligence test enthusiasts would have us believe. Indeed, the relationship seems to rest mainly on the simple fact that knowledge of one's language, required in scholastic situations, happens to be measured by certain kinds of intelligence tests.

A more cogent argument may be made from the way in which scholastic achievement may be predicted from measures of mental ability. Here we need not be concerned with putative causal relationships. However, the results of factor analysis may be expected to throw light on what happens when an "intelligence" test is used to predict scholastic success. Some intelligence tests are undoubtedly composite measures of several factors of ability, such as verbal ability, reasoning ability, numerical ability, and spatial ability. The verbal score of the *Scholastic Aptitude Test* was shown in this investigation to measure primarily verbal ability. The writer attempted to predict scholastic success from an "intelligence test" artificially constructed by combining scores from certain tests of the mental ability factors studied here. The following tests were those selected as representative of the respective factors:

Factor *A:* Scholastic Aptitude—Verbal Score [28]
Mount Holyoke Vocabulary Test [29]
Mount Holyoke Reading Test [26]
Factor *B:* Morpheme Recognition [20]
Thurstone Reasoning II [23]
Factor *C:* Paired Associates [19]

The multiple correlation between the first-year college average [25] and the six variables listed was found to be .451. The independent contributions of each of the variables are given in Table 9, which also presents data concerning the prediction of

TABLE 9

Independent Contributions of Certain Variables (X) in Predicting Certain Other Variables (Y), together with Multiple Correlation Coefficients

		Y variables							
		17	22	24	25	31	32	33	38
X variables	19	.032	.017	.003	.012	−.005	−.003	.000	.005
	20	.020	.110	.054	.063	.010	.049	.004	−.018
	23	.038	.127	.059	.026	.044	.010	.025	−.010
	26	.066	.066	−.015	−.004	.062	.078	.070	.011
	28	.137	.208	.086	.101	−.018	−.018	−.042	.177
	29	.004	.027	.016	.005	.128	.039	.112	.066
	R^2	.297	.555	.203	.203	.221	.155	.169	.231
	R	.545	.745	.451	.451	.470	.394	.411	.481

certain other variables. In the prediction of scholastic success it is to be noted that the *Scholastic Test* and *Morpheme Recognition* make significant contributions, while *Paired Associates,* the only representative of factor *C,* makes no significant contribution. For factors *A* and *B,* one test makes an independent contribution in each case. It may be expected that one and only one test representing a given factor could possibly make a significant independent contribution to prediction, since several relatively pure tests of a given factor ordinarily measure only one independent trait. The most striking illustration of this rule is seen in the case of variables 28 and 29. In all the predictions set out in Table 9, either one of these variables, but never both, makes an independent contribution. Little is gained in prediction if more tests of the same factor are added to a predictive battery. Multiple correlation coefficients can be raised

only by the inclusion of tests of new and relevant factors in a predictive battery.

The results presented in Table 9 as to the prediction of variables other than 25 add weight to the conclusions drawn from the factor analysis. *English Composition Final Grades* [24] may be predicted with precisely the same accuracy as the first-year college average. The verbal tests, and to a lesser extent reasoning tests, play a part in predicting scores on the subtests of the psychology examination, and there are no appreciable differences between these subtests with respect to the factors required in predicting them. The projection of the *Scholastic Aptitude Test* on factor *F* is reflected in the amount of contribution made by the *Scholastic Aptitude Test* in predicting variable 38. The way in which the six independent variables contribute to the prediction of variables 17 and 22 seems to be determined by the factorial compositions of these latter variables. For example, variable 17, a relatively pure test of factor *A*, may be predicted from tests of factor *A*, while variable 22, a measure of both factors *A* and *B*, is independently predicted from tests of both of these factors.

One of the questions studied in this investigation was whether the subtests of an objective achievement examination would show differential relationships to the mental ability factors studied. To this question a simple answer may be given: on the basis of this investigation there appear to be no such differential relationships. All four types of achievement items used measure the factor of scholastic achievement in psychology with equal purity. Achievement items cast in the form of analogies are not correlated with tests of factor *B* (reasoning) any more than are other kinds of items, contrary to the original expectation.

It is obvious from the original correlations and from the factor analysis that scholastic achievement is not significantly related to the kind of achievement represented by the *Cooperative Contemporary Affairs Test.* The suggestion that acquisition of knowledge is a general trait covering not only the knowledge gained in formal schooling but also information learned incidentally is not favored by these results. Instead, the ac-

quisition of information appears to be specialized in a number of directions, two of which are represented by factors *F* and *G* of the present study.

Summary

Tests of mental ability and scholastic achievement were administered to 88 women students in elementary psychology classes. These tests included measures of vocabulary, grammar, reading rate, reading comprehension, rote memory, and reasoning ability. In addition, scores were obtained on six subtests of the *Cooperative Contemporary Affairs Test*, four subtests of an objective examination in general psychology (true-false, multiple choice, analogies, and single-word completion), and the verbal section of the *College Entrance Examination Board Scholastic Aptitude Test*. Academic averages and final grades in English composition were also studied.

A multiple factor analysis of the intercorrelations of 26 variables yielded ten centroid factors. Rotation of the coordinate axes to simple structure revealed seven identifiable factors. These were: a factor similar to the *V* (verbal knowledge) factors of previous studies; a reasoning factor similar to Thurstone's *D* (deductive) factors; a rote memory factor; a scholastic achievement factor represented mainly by the subtests of the psychology examination; a doublet factor linking the first-year college average with grades in English composition; a factor representing knowledge of contemporary social and political events; and a factor involving knowledge of current developments in literature, fine arts, and amusements.

These factors, though linearly independent, were found in some cases to be correlated to an appreciable extent. A general factor seems to be indicated by a second-order factor analysis of the correlations between the primary factors. A linkage between the two primary factors measuring knowledge of contemporary affairs is also demonstrated.

For the population studied, the bond between mental ability and academic achievement appears to be smaller than is usually assumed. It probably rests upon the fact that verbal knowledge is involved both in intelligence tests and in scholastic

situations. Neither reasoning ability nor rote memory seems to have any marked relation to the types of scholastic achievement studied here. Tests of verbal knowledge and of reasoning ability make independent contributions to the prediction of scholastic success, however.

No evidence was found to support the hypothesis that the subtests of an objective achievement examination have differential relationships to the several mental ability factors.

It was found that scholastic achievement is not significantly related to the kind of achievement represented by the *Cooperative Contemporary Affairs Test.* The tendency to acquire knowledge is thus not a general trait.

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MEASUREMENT AND THE SELECTION OF SALESMEN

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WHEN a business enterprise begins to face the task of beating its swords back into plowshares, one of the most disturbing problems is the rebuilding of a sales organization. This is especially true when the life and strength of a business depend upon successful merchandising in highly competitive markets. For such business enterprises, myriads of salesmen will be needed when peace comes. Their selection, training, and placement becomes a front rank problem in post-war planning for personnel managers.

Judging from reported researches in this field during the last two years, one must assume that educational or psychological measurements have done little or nothing to help business and industry with this particular task. Even before that time one could not point to any notable or significant accomplishments. This is not surprising because such a problem presents many varied and elusive factors. Work requirements for salesmen are far from standardization, hence criteria of success are difficult to determine. Shartle (19) once said: "We have studied something like 20,000 occupations and we find that the difficulty encountered in devising improved selection techniques for saleswork is probably not equaled in any other group of occupations."

Many measurement studies in salesmen selection have been reported, showing varying degrees of success, but they are scarcely more than suggestions of channels that might be

opened in the future. Kornhauser and McMurry (9), after two years of careful follow-up study, noted a reduction in turnover of 23%, and an increase in production level equal to 6.5% per man. In their study a weighted personal history (application) blank, personality test items, and standardized analytical interviews were used. The first two devices alone were able to eliminate 31.8% of those later shown to be failures, and 22.4% of the mediocre men, while losing 6.7% of good men. Goldsmith (5) set a critical score on a weighted personal history blank which eliminated 54% of the failures while losing 16% of successful men. The Life Insurance Sales Research Bureau has developed an "Aptitude Index" (11, 13) consisting of two parts, i.e., weighted personal history items and a test of personality characteristics. The relative weights of these two parts depend on the age group to which the applicant belongs. This index yielded a validity coefficient of 0.40 when correlated with amount of sales as a criterion.

Reports as to salesmen and measures of extraversion and dominance vary considerably (1, 4, 17, 14, 6, 2). The Bernreuter test is frequently used in these studies. Some of the companies have selected from the personality tests just those items having validity in their own situation. Lovett and Richardson (14) claim validity for a homemade test of social attitudes, finding that salesmen have a tendency toward conventionality. These authors find little value in testing for mental alertness. Schultz (18) supports this view in general, but points out that intelligence tests do help eliminate those from the very bottom. Job analyses made in Radio Corporation of America on distributor and specialist sales jobs seem to indicate that intelligence would be a factor important to success.

Ohman (15) and Ream (16) found success with some specially constructed tests of sales ability. One must be on guard, however, against testing for "general sales ability" because each company has a unique situation (10).

Strong's (20) interest inventory was used with some predictive accuracy when scored for "life insurance salesmen." This test plus a personal history blank was used by Bills (2), and she reported the Strong test alone was "good for the pur-

pose." Bills found it necessary, in setting up prediction scores, to group the subjects by age.

Rating scales for salesmen's traits have been tried by Knowles (8), who evaluated appearance, character, intelligence, ability to get along with others, industry, initiative, efficiency, and leadership. This method requires a rater who has wide experience with salesmen, close contact with ratees, and training in rating. Rating seems to be a questionable selection device, even though it often has usefulness as an evaluation of success or adjustment.

Difficulties in developing selection devices for salesmen seem to fall into two types: (1) those due to inability to isolate and measure personality attributes, and (2) those due to the specificity of a salesman's work. These must not be regarded, however, as insurmountable difficulties. Those who are interested in this field should undertake to find sources of improvement in dealing with them. Whether we shall ever be able to get a job analysis for salesmen that will have common factors is an open question.

1. *Personality Attributes.* Success in selecting salesmen undoubtedly waits on better techniques for measuring "personality." The instruments enjoying the widest usage today are the Bernreuter, the Bell, the Humm-Wadsworth, and the Thurstone schedule. All of these tests rest on rather questionable validity claims.[1] Thurstone himself (3) warns against using his test in comparing different population samples. Experiments with the Bernreuter have given a variety of reports as to its value in discrimination; it seems to be able to pick many maladjusted cases, but it is not dependable in reporting good adjustment (21). It is questionable whether a test which is standardized by selecting extreme deviates can be applied to differentiating among normals. Answers of deviates may be significant only as a part of a larger psychotic pattern. Such tests, and this is an oft-repeated criticism, assume that we can get an honest self-report from the testee on a large number of very personal questions. The many homemade

[1] Cf. Kirkpatrick, F. H. "The Validity of the Thurstone Personality Schedule," *Proc. West Virginia Academy of Science,* Vol. 10, 1937, for critical discussion of the Personality Schedule's validation.

personality measures used for salesmen are largely patterned after these well-known tests.

Recent studies of personality emphasize the wholeness of the individual's psychological life. The habits, attitudes, sets, traits, etc., which have been offered as elements of personality are resultants of a dynamic interplay of responses being made to a wide variety of influences. There is a carry-over of tensions from one life situation to another, often to areas where their appearance is not recognized consciously (12). These tensions can be generated by mental conflicts between motives and obstacles, recognized or not recognized, in all areas of one's life.

Therefore, assuming we are dealing with non-abnormal persons, it seems safe to deduce that the important personality information should be concerned not so much with the symptoms of maladjustment as with the sources of conflict that may lead to *any* maladaptations. In selecting successful salesmen, it is important to find those whose psychological environments will be conducive to continued good adjustments. In an indirect way the success of the personal history blank may be attributed to this principle.

One area for further research then would be concerned with the conflicts that are found detrimental in sales work. Methods of measurement for sources of conflicts must be devised. One method which might prove useful is the measuring of attitudes toward the home situation, society, races, etc., which might be favorable or unfavorable to adjustment.[2] Attitudes can be measured without too much prying into one's personal affairs. Instead of asking a person if he is maladjusted, as some of our present tests do, we note expressions of his thinking and interpret them in the light of our knowledge.

The *projective techniques* for diagnosing personality might be helpful in this particular field. Recent researches indicate that effective group studies can be conducted with the Rorschach ink blot test. The comprehensive scoring methods of the Rorschach might uncover significant relationships with

[2] R. S. Schultz in *Wartime Supervision of Workers*, page 21, presents an approach to this type of measurement for plant foremen.

sales success. At least, it is worth trying. There is also need for systematic study of the *situational relationships* in which a salesman is placed. More than an individual's personality make-up is involved in a sales job. There are usually two people to a sales situation. The nature of the relationships involved in a sales interview should be studied with a view toward predicting the type of clientele with which a particular salesman will and will not be successful.

2. *Specificity of Sales Work.* Workers in the field of salesmen selection are disturbed by difficulties with the evaluation of their methods. Criteria are set up only to be found unstable in the face of a great diversity of situations met by the salesmen. Amount of earnings cannot be taken as a criterion of success, since some salesmen have territories which make selling easier for them. For the same reason volume of sales is inadequate. The cost of a salesman to the company as a criterion is influenced by the nature of the territory and by the amount of adjustment required of a particular salesman to a particular territory. Ohman (15) found salesmen's net commission earnings to be most suitable in his study, although this does depend on the difficulty-value of the job, as fixed in the assigning of commission bases. A battery of criteria used by Lovett and Richardson (14) consisted of descriptive rating scales, paired rating scale, confidential report on job adjustment and personality, percentage of quota sold, percentage of dealers sold, and cost of selling per box of soap. In situations where individual job differences make "objective" criteria difficult, rating scales in the hands of trained managers and supervisors may be the best solution.

In selecting his group of salesmen for experimentation the psychologist must consult experts in the sales and marketing departments for assistance in finding those men whose jobs present about equal situations. The opinions of district managers and of seasoned salesmen will be of value in this respect. It will be true, nevertheless, even with all these expert opinions and careful analysis that the job situations are not fully equated. We can only attempt the closest approximations, remembering that when we cannot control all the factors influ-

encing the experimental variable, we must try to define and measure the errors introduced. Much labor in this direction will be rewarded by increased accuracy in evaluating our measuring instruments.

Summary

1. There is need for much further measurement research in the selecting of salesmen.

2. The tools found most effective have been: standardized personal history blanks, personality tests, interest tests, and interviews.

3. Two chief obstacles have been the difficulty of measuring personality attributes and the nature of a salesman's work.

4. Such areas as the following are suggested for future research:

(a) Tests for *areas of conflict* which lead to poor adjustment
(b) Experiments with the use of projective techniques
(c) Study of sales situations
(d) Better methods for determining criteria of success and for regulating experimental designs

5. The development of thorough selection techniques and the subsequent building of a selection pattern must be undertaken by each company and on the basis of careful job analyses.

6. It is likely that painstaking interviewing procedures have proved their worth in selection. Most studies indicate that the more we know about the whole man and the company situation the better we can predict behavior; and that a big question for any company undertaking a salesman selection program has to do with how much time and personnel are to be spared in carrying it through.

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A STUDY OF THE RELATION OF KUDER PREFERENCE RECORD SCORES TO VARIOUS OTHER MEASURES[1]

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THE purpose of this study is to report the relationships between each of the various scales on the Kuder *Preference Record* and (1) the other scales of the same blank, (2) the group scales on the Strong *Vocational Interest Blank for Men,*[2] (3) general ability, and (4) achievement in certain subject-matter areas, using Form B of the *Preference Record* in each case. Other descriptive statistics concerning the *Preference Record* are also presented in Section 1.

The subjects for this study are two hundred sixty-seven students who took both of the interest tests at the Personnel Bureau at the University of Illinois. That there was some selection is evident in that there were at least as many more students tested in the Bureau who did not take both tests. The factors accounting for this selection are so numerous, however, that they will not be reviewed. The fact is that there is a strong possibility that because the factors are so numerous

[1] A series of articles on the relationship of the Kuder *Preference Record* to various other objective measures was planned at a conference at Ohio State University in August of 1941. This article is the second study to be reported in that series. As originally planned, this study was to include also the significance of differences of means on the scales of the Kuder *Preference Record* and group scales on the Strong *Vocational Interest Blank,* for students registered in various colleges at the University of Illinois. It is understood that this work is being completed and will be reported from the University of Illinois. The fact that the basic data were prepared by the author for that study made it possible to prepare the present study much more expeditiously. Appreciation is hereby expressed to Lt. Commander Daniel D. Feder, Dr. A. E. Traxler, Dr. G. Frederic Kuder, and Dr. E. K. Strong for help in planning this series of studies and to the first three for valuable criticisms of the present manuscript.

[2] Since there are no group scales available on the Strong *Vocational Interest Blank for Women,* another way had to be found to report these relationships for women. They will be reported later.

the sampling may be quite heterogeneous. Suffice it to say that the extent of the selection and its effect on the results are by necessity indeterminate.

Of the two hundred sixty-seven subjects, one hundred one were women and one hundred sixty-six were men. The distribution of these students according to college and class at the University is shown in Table 1.

TABLE 1

Distribution of 267 Subjects by Schools and by Classes in Which They Were Registered (N = 101 Women and 166 Men)

Subjects	College								Class				
	L. A. S.	Commerce	Eng.	Agr.	Educ.	Fine Arts	P.E.	No Col.*	Fresh.	Soph.	Junior	Senior	Uncl.*
Men	82	21	48	5	1	6	3	..	110	15	16	4	21
Women	60	2	..	12	..	1	1	25	66	14	5	2	14

* Includes pre-college.

1. *Relationship between Each of the Various Scales on the Kuder* Preference Record *and Other Scales of the Same Blank and Other Descriptive Statistics Concerning It*

The Kuder *Preference Record* is an instrument for the objective measurement of interests. Traxler's article (6, *253*) gives a description of the construction of the first edition of this test and data on its reliability. Nine scores are obtained from Form B of the Kuder *Preference Record,* namely, mechanical, computational, scientific, persuasive, artistic, literary, musical, social service, and clerical. The seven scales for which Form A is scored were developed in accordance with the objective of producing relatively independent scales. Use of the form in vocational guidance revealed that two areas, mechanical and clerical, were not adequately represented. The author of this test reports that the scales for these areas were developed by the method of internal consistency and included in Form B, in spite of the fact that there was some overlapping with the other scales.

The distribution of means on the scales of the Kuder *Preference Record* according to sex is shown in Table 2. Also included in this table are estimates of the lower limit of reliability by the Kuder-Richardson formula (21), which produces coefficients which may be regarded as underestimates of the true reliability.

TABLE 2

Mean Scores, Standard Deviations, and Reliabilities of the Scales of the Kuder Preference Record *for University Students (N = 101 Women and 166 Men)*

Scale	Highest possible score	Men			Women		
		Mean	S.D.	Lower limit of reliability*	Mean	S.D.	Lower limit of reliability
1. Mechanical ..	128	63.31	22.24	.94	44.26	17.20	.91
2. Computational	74	34.61	12.64	.90	26.43	11.26	.88
3. Scientific	112	68.68	18.36	.93	49.35	14.87	.88
4. Persuasive ..	140	69.57	21.77	.93	66.06	22.13	.94
5. Artistic	102	43.86	15.95	.91	52.21	15.41	.90
6. Literary	106	53.69	15.71	.90	58.83	17.01	.92
7. Musical	46	20.36	9.87	.90	24.54	8.20	.85
8. Social Service	138	69.82	19.23	.91	81.82	18.18	.90
9. Clerical	118	43.31	15.42	.89	56.56	14.28	.86

* Computed by the Kuder-Richardson formula (21), which ordinarily slightly underestimates the test reliability. See G. F. Kuder and M. W. Richardson, "The Estimation of Test Reliability," *Psychometrika*, II (1937), 151–160.

The intercorrelations of the scores on this test presented separately for sex are given in Tables 3 and 4. The scales show a surprising lack of relationship. The highest positive relationships evident between the scales are between the clerical and computational for both men and women and between the mechanical and scientific for men.

TABLE 3

Intercorrelations of Scores on Nine Scales of the Kuder Preference Record *for 166 Men*

	Computational	Scientific	Persuasive	Artistic	Literary	Musical	Social Service	Clerical
Mechanical	−.084	.470	−.183	.165	−.500	−.400	−.172	−.339
Computational .		.222	−.148	−.328	−.058	−.131	−.254	.561
Scientific			−.398	−.106	−.190	−.297	−.202	−.261
Persuasive				−.251	.106	−.026	−.022	.109
Artistic					−.194	.044	−.215	−.299
Literary						.194	−.178	.060
Musical							−.014	.155
Social Service ..								−.299

TABLE 4

Intercorrelations of Scores on Nine Scales of the Kuder Preference Record *for 101 Women*

	Computational	Scientific	Persuasive	Artistic	Literary	Musical	Social Service	Clerical
Mechanical	−.051	.340	−.136	−.035	−.287	−.301	−.225	−.134
Computational .		.335	−.219	−.224	−.256	−.261	−.052	(411)
Scientific			−.402	−.090	−.385	−.292	.002	−.175
Persuasive				−.139	.264	−.124	−.058	−.076
Artistic					−.133	.186	−.278	−.311
Literary						.134	−.150	−.071
Musical							−.146	−.076
Social Service ..								−.234
					N = 166	100		
Levels of significance:				1%	.208	.254		
				5%	.159	.195		

2. *The Relationship between the Scales on the Kuder* Preference Record *and the Group Scales on the Strong* Vocational Interest Blank for Men

Traxler and McCall have recently discussed the place of objective measurement of interests in a guidance program (6). They point out the trend away from measurement of interests in specific occupations or vocations to measurement of interests in broad occupational areas. They give as reasons that interests in some specific occupations are rather highly correlated and that guidance workers have found that reliable measurement of interests in broad areas is more practical for counselling purposes.

These two methods of measurement may be illustrated by the two techniques for scoring the Strong *Vocational Interest Blank for Men.* This inventory may be scored by using keys for each of thirty-four occupations, such as medicine, engineering, Y.M.C.A. Secretary and others, or by using group scales which cover occupational areas, as follows: creative-scientific, scientific, social service, detailed business, business contact, and linguistic. Strong has recently described these Group Scales and has discussed their use (5, *169–182*).

A report has been published on the relationship of scores on individual keys on the Strong *Vocational Interest Blank* to the Scales of the Kuder *Preference Record* (7).

This article reports the relationship which exists between the Group Scales on the Strong *Vocational Interest Blank for Men* and the Scales of the Kuder *Preference Record.* The plan of this part of the study was to use the high and low scores on both sets of data, omitting the less significant scores (from the point of view of vocational counselling) which fell in the middle range. A criterion for determining significantly high and significantly low scores had to be set. The points on the *Preference Record* used in an earlier study were also used here (7). The data were punched on International Business Machines cards as follows: Each score on the Kuder was separately coded according to its percentile value: seventy-fifth percentile and above equalled 1, twenty-fifth percentile and below equalled 2, twenty-sixth through the seventy-fourth percentiles equalled zero.

The procedure followed was then to sort out all of the cards which had scores above the seventy-fifth percentile on a specific scale on the Kuder *Preference Record,* the cards having scores below being discarded for the time. These cards were then sorted for the distribution on the first Strong Group Scale. The number of subjects receiving each letter score on the first Group Scale was then recorded. The same was done for the other Group Scales. The cards were then resorted for those punched to indicate scores below the twenty-fifth percentile on the same Kuder scale. The median scores on these tabulations are shown in Table 5.

The same relationship was then investigated further by correlating the scores on each Group Scale of the Strong *Vocational Interest Blank* with the scores on each Scale on the Kuder *Preference Record.* These correlations are presented in Table 6.

These data will not be interpreted score by score. A detailed study of them, however, should be valuable to the counsellor as an aid in interpreting scores on either of these interest inventories.

These data also have theoretical interest. The relationship between interest inventories as reported in the literature has not been high (2). Some writers have even gone so far

TABLE 5

Median Letter Scores of High and Low Groups on the Scales of the Kuder Preference Record *for Scores on the Group Scales of the Strong* Vocational Interest Blank for Men (*High is above the seventy-fifth percentile; low, below the twenty-fifth; N = 166 men*)

Strong Group Scales	Scales on the Kuder *Preference Record*																	
	Mechanical		Scientific		Computational		Persuasive		Artistic		Literary		Musical		Social Service		Clerical	
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Creative-Scientific	B	B	B	C+	B–	B	B	B	A	B–	C+	B+	B	B	B	B	B	C+
Scientific	B	C	B	C	B–	B–	B	B+	B–	B–	C	B+	B–	B–	B–	B	B	C+
Social Service	B	A	B	A	B	B+	B	B+	B	B	B–	B	B	B	A	B	B	B
Business Detail	B–	B+	B–	B+	B	B–	B	B	C+	B	B+	B–	B	B	B	B	B–	A
Business Contact	B–	A	B–	A	B	B	B–	B+	B–	B	A	B	B+	B	B+	B	B	A
Linguistic	B–	B+	B	B+	B	B	B–	A	B+	B	B	C+	B–	B	B	B+	B	B

TABLE 6

Correlations between Group Scales on the Strong Vocational Interest Blank *with Scores on the Scales of the Kuder* Preference Record

(*N* = *166 men*)

Strong Group Scales	Mechanical	Computational	Scientific	Persuasive	Artistic	Literary	Musical	Social Service	Clerical
Creative-Scientific	.134	−.201	.307	−.626	.443	.007	.146	−.038	−.346
Scientific	.539	.101	.614	−.532	.238	−.211	−.161	−.217	−.308
Social Service	−.217	−.199	−.163	.122	−.149	.180	.064	.332	−.133
Business Detail	−.146	.429	−.293	.412	−.386	−.029	−.011	.133	.591
Business Contact	−.447	−.090	−.536	.693	−.258	.219	.070	.097	.232
Linguistic	−.521	−.293	−.292	.022	.135	.500	.285	.076	−.082

as to suggest that no interest inventory be used in counselling because of the lack of relationship reported. It is evident from these data that a relationship does exist between the two inventories concerned. A correlation such as .693 between the Persuasive Scale and the Business Contact Group Scale indicates substantial and striking agreement in the light of evidence previously reported on the subject. Of no less importance are the negative relationships, which become even more significant when compared to the table of intercorrelations of the scores on the Kuder *Preference Record* and like data for the Group Scales presented by Strong (5, *171*).

3. *The Relationship of General Ability as Measured by the* American Council on Education Psychological Examination *to Objectively Measured Interests*

Research has not indicated a substantial relationship between interests and general ability. Using the total score on the *American Council on Education Psychological Examination* as a criterion of general ability, Segel and Brintle (4) found the following relationship to interests as measured by scores on certain keys of the Strong *Vocational Interest Blank:* Engineering, .10; Medicine, – .02; Law, .00; Life Insurance, – .12; Personnel Management, – .08; Purchasing Agent, – .32. The last correlation is the only one that could not be accounted for by chance.

Adkins and Kuder found more substantial relationships when they investigated the relationship of abilities as measured by the Thurstone *Tests for Primary Mental Abilities* and interests or preferences for certain activities as measured by the Kuder *Preference Record* (experimental edition). While some relationships not to be accounted for by chance were found, the highest relationship found is expressed by the correlation of .39 between scores for women on the Computational Scale of the *Preference Record* and the number composite of the Mental Abilities Tests. The array of relationships found led the authors to state that ". . . the interpretation of preference scores as indicative of the presence or absence of special abilities is unwarranted by the results of this investigation" (1, *261*).

It should be noted that there are certain differences between the instruments used to measure interest and ability in the two studies just reviewed. Measurement of interest in the first study was specific to various occupations; in the latter the measurement of interest is by scales in occupational areas. Ability was measured by a general over-all score in the first study; in the latter certain components of ability were measured separately. These differences in techniques of measurement should be kept in mind as additional data are now reported.

The *American Council on Education Psychological Examination* in its present form yields a total score made up of two part scores called "Quantitative" and "Linguistic" (usually referred to as "Q" and "L" scores). It is thought that predictions for success in work requiring symbolic and numerical

TABLE 7

Correlations between Scores on Nine Scales of the Kuder Preference Record *and Scores on* American Council on Education Psychological Examination (*N = 153 for men; 81 for women*)

Kuder Scales	Scores on the American Council on Education Psychological Examination					
	Men			Women		
	Total	Q	L	Total	Q	L
Mechanical	−.073	−.065	−.087	−.047	−.069	−.038
Computational	.105	.252	−.038	.124	.371	−.183
Scientific	.041	.059	.026	.112	.027	.020
Persuasive	.010	−.011	.035	.332	.103	.208
Artistic	−.030	−.126	.054	.286	.026	.189
Literary	.273	.106	.383	.415	.009	.437
Musical	.069	.042	.085	−.079	−.104	−.084
Social Service	−.258	−.188	−.289	−.010	−.078	−.213
Clerical	.030	.147	−.081	−.010	−.062	−.269

ability can best be made from the "Q" score, while success in pursuits requiring linguistic skill may be most successfully made from the "L" score. Using this test as a measure of general ability, the relationship between ability and interest as measured by Form B of the Kuder *Preference Record* was further investigated. The data are reported in Table 7. These correlations are reported separately by sex. The correlations

for women tend to be higher than those for men. There is notable agreement as well as notable disagreement between the two sets of data. In both cases prediction of linguistic ability from the Literary Scale is markedly better than prediction of quantitative ability, which is as might be expected. In the case of women, nearly as good a prediction could be made from the total score. There is a significant relationship between the "Q" score on the A.C.E. and the Computational Scale on the *Preference Record* for both men and women, but neither the total score nor the "L" score indicates a significant relationship with this Scale. Two other significant positive relationships appear for women: the relationships between the total score on the A.C.E. and the Persuasive Scale and between the total score on the A.C.E. and the Artistic Scale of the *Preference Record.* These relationships are almost zero in the case of the data for men. Two negative relationships which should be noted appear for men. Both the total score and the "L" score on the A.C.E. show negative relationships to interests in the social sciences. While the same tendency is apparent for the "L" score for women (the relationship being significant at the five per cent level), such is not apparent for the total score.

The explanation for the difference between relationships as reported between these two studies is not immediately apparent. The author would like to suggest, however, that in the present study the areas in which interests and abilities are being measured are more similar than in the former studies, and that this fact may account for the greater percentage of significant correlations.

4. *The Relationship of Achievement as Measured by Standardized Achievement Tests and Interests as Measured by the Scales on the Kuder* Preference Record

> ". . . without selective interest, experience is an utter chaos. Interest alone gives accent and emphasis, light and shade, background and foreground—intelligible perspective, in a word" (*3, 402*).

If, given the ability to learn, interest is the factor which gives direction to that to which an individual attends, logically it

might be expected that research would show a relationship between interest and ability and between interest and achievement. In fact, however, while this hypothesis has not been entirely disproved by research, neither has it been confirmed.

Research of this nature must utilize existing criteria for the measurement of the factors to be related. For instance, estimates of achievement may be judged by teacher's grades or by scores on objective tests. Scores on interest inventories, which are little more than expressions of an individual's subjective concept of himself within the frame of reference presented to him in the interest questionnaire, are at present our best objective measures of vocational interests. Achievement test scores are perhaps the more stable of the two criteria mentioned. Remarkable progress has been made in the measurement of ability; however, estimates of ability are still largely dependent upon expressions of achievement. Thus it may be that the true relationship among interest, ability, and achievement will not be apparent until there is greater refinement of techniques of measurement.

TABLE 8

Correlations between Certain Vocational Interest Blank *Scores and Four* Iowa High School Content *Scores* (*N* = *100 junior college boys*)

Iowa High School Content	Engineering	Medicine	Law	Life Insurance	Personnel Management	Purchasing Agent
English Literature	−.10	−.11	.09	−.04	.10	−.43
Mathematics	.49	.28	−.03	−.27	−.15	.04
Science	.36	.29	−.01	−.29	−.17	−.26
History and Social Studies	−.16	−.05	.09	.08	.04	−.26

Turning to the literature for studies already reporting relationships between achievement and interest, the extent of the work done on this problem is found to be meager. Segel and Brintle reported correlations between scores on the *Iowa High School Content Examination* and certain keys on the Strong *Vocational Interest Blank for Men,* as presented in Table 8 (4). These results suggest that there is a significant relationship between achievement as measured by the *Iowa High School*

Content and interest as measured by certain interest keys. This same relationship was investigated using the Scales of the Kuder *Preference Record* as the objective measure of interest and the *Iowa High School Content* and the *Iowa English Training* as the measures of achievement. The data are reported separately for men and women in Table 9.

The relationships found in the present study are not out of line with those found by Segel and Brintle. Interest in science is significantly and positively related to background in science and mathematics for both women and men. Interest in mechanical and computational pursuits is also positively related to achievement in mathematics for both men and women, though the latter correlation is significant at the five per cent level only. For men, scores on the *Iowa English Training* are negatively correlated with mechanical interests, while for women there is no significant relationship. Interest on the Literary Scale of the *Preference Record* is related to background in English literature, English training and social science for both men and women, though the relationship between the latter for men is significant at the five per cent level only. Interest in literary pursuits is also significantly related to reading rate and comprehension as measured by these two scores on the *Iowa Silent Reading Tests* (the comprehension score in this case being a total of all subscores on the test except the one on rate of reading).

Correlations between the Social Service Scale and background in English, mathematics, and general science for men show significant negative relationships as was true on the A.C.E. This is not true of the same relationships for women.

Clerical interests for women are correlated significantly (at the one per cent level) and negatively with background in English literature and with reading rate, and (at the five per cent level) with background in general science, social science, and English training. This was also true for the "L" score of the A.C.E. None of these relationships for men is significant.

5. *Conclusions*

This article has presented data to support the following conclusions:

TABLE 9

Correlations between Scores on Nine Scales on the Kuder Preference Record *and Scores on the* Iowa High School Content, *the* Iowa English Training *and the* Iowa Silent Reading Tests

Achievement tests	N	Scales on the Kuder *Preference Record*								
		Mechanical	Computational	Scientific	Persuasive	Artistic	Literary	Musical	Social Service	Clerical
					Men					
English Lit.	100	−.001	−.002	.090	−.106	.094	.399	.040	−.259	−.034
Mathematics	100	.226	.344	.360	−.196	−.012	−.020	−.155	−.260	.014
General Science	100	.153	.092	.319	−.137	.013	.023	−.034	−.260	−.077
Social Science	100	.024	.090	.183	−.045	−.004	.205	−.144	−.174	.009
English Training	95	−.264	.123	.047	−.125	−.042	.298	.189	−.063	.069
Iowa Reading Rate	132	−.116	−.022	−.014	.069	.025	.178	−.082	−.135	.040
Iowa Read. Comp.	132	−.124	.027	.064	.038	−.055	.265	−.019	−.138	−.004
					Women					
English Lit.	73	.143	−.158	.090	−.028	.177	.329	−.023	−.142	−.387
Mathematics	73	.225	.360	.182	.056	.041	−.031	−.221	−.059	−.159
General Science	73	.099	.105	.419	−.099	−.146	−.034	−.128	.172	−.227
Social Science	73	.095	.040	.048	.104	.190	.313	−.149	−.156	−.253
English Training	71	.061	−.119	.024	.007	.064	.304	−.007	−.082	−.224
Iowa Reading Rate	83	−.007	.023	.230	.076	.076	.258	−.120	−.188	−.305
Iowa Read. Comp.	83	.033	−.056	.113	.102	.019	.259	−.110	−.125	−.167
				N = 150	130	100	80	70		
Levels of significance:			1%	.208	.228	.254	.283	.302		
			5%	.159	.174	.195	.217	.233		

1. The reliabilities of the Scales of the *Preference Record* Form BM are high enough to be used in counselling individuals.
2. The Scales on this interest test tend to be independent.
3. There is fair agreement between interests as measured by the group Scales on the Strong *Vocational Interest Blank for Men* and the Scales of the Kuder *Preference Record.*
4. More marked relationships between ability and interest than have been found in previous studies tend to be evident when the tests used measure similar factors, such as computational interests and computational abilities, rather than general ability and specific interests or vice versa.
5. Relationships between interests as measured by the *Preference Record* and achievement as measured by achievement tests, support previously reported conclusions that both types of data are necessary for adequate counselling, though some significant relationships tend to indicate that interests and achievement are not totally unrelated.

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RELATIONSHIPS BETWEEN CERTAIN ASPECTS OF INTELLIGENCE AND CERTAIN ASPECTS OF READING

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AMONG the relations between aspects of intelligence and reading abilities that have been studied are (1) the correlation coefficients between certain total intelligence-test scores and certain total reading scores, (2) the correlation between subtests of both intelligence and reading, (3) the relation between individual growth curves of intelligence and reading, and (4) the relation between growth in reading and the total growth of the child. Previous research on these aspects of the problem will be briefly summarized and some original data presented.

Correlation between Total Intelligence-Test Scores and Total Reading Scores

The majority of correlations between group tests of intelligence and tests of silent reading lie between 0.50 and 0.70. An I.Q. obtained from the typical verbal group intelligence test may be largely a reading score and, in fact, has been increased, on the average, ten to twelve points as a result of effective instruction in reading. The correlations tend to be somewhat lower when the Binet test is used and markedly low when a performance test is employed as the measure of intelligence.

Correlation between Subtests

"In general, tests of rate of reading show lower coefficients of correlation with results of intelligence tests than do tests of

vocabulary and sentence and paragraph comprehension. This lower correlation between rate and intelligence may be due in part to the lower reliability of tests of reading rate."[1]

When an intelligence test consists of a language and a non-language section, the difference between the scores on the two sections of the intelligence test and reading scores is striking. Using the *California Test of Mental Maturity* and two reading tests with seventy-four ninth-grade pupils, Traxler[2] obtained the following coefficients of correlation:

Language factors on the *California Test of Mental Maturity* with *Iowa Silent Reading Test*	.685 ± .041
Non-language factors with *Iowa Silent Reading Test*	.356 ± .068
Language factors with *Traxler Silent Reading Test*	.753 ± .034
Non-language factors with *Traxler Silent Reading Test*	.357 ± .068

Somewhat similar results[3] were obtained by the writer using the Elementary Series of the *California Test of Mental Maturity* with children in elementary grades:

Language factors with *Thorndike-McCall Reading Test*	.824
Non-language factors with *Thorndike-McCall Reading Test*	.557
Language factors with *Gates Silent Reading Test, Type A*	.805
Non-language factors with *Gates Silent Reading Test, Type A*	.359
Language factors with *Gates Silent Reading Test, Type B*	.799
Non-language factors with *Gates Silent Reading Test, Type B*	.413
Language factors with *Gates Silent Reading Test, Type D*	.844
Non-language factors with *Gates Silent Reading Test, Type D*	.514

Each of the four reading tests correlates definitely lower with the non-language than with the language scores of the *California Test of Mental Ability*. Apparently, the language part of the intelligence test measures one kind of mental ability and the non-language another type. There is some indication that the language type of test may be the better measure of basic mental ability. Obviously, however, the language-type intelligence tests and certain reading comprehension tests have in common a considerable amount of this verbal factor. This

[1] Strang, Ruth. *Problems in the Improvement of Reading in High School and College* (Revised Edition). p. 209. Lancaster, Pennsylvania: The Science Press Printing Company, 1940.

[2] Traxler, Arthur E. "A Study of the California Test of Mental Maturity: Advanced Battery." *Journal of Educational Research*, XXXII (1939), 329–335.

[3] Raw data were made available to the writer by Dr. Roma Gans, and statistical computation was made under the direction of Dr. Irving Lorge.

being the case, it is quite possible for a bright child having reading or general language difficulty to give the impression, on a verbal intelligence test, of having low mental ability.

As would be expected, the correlation between scores on reading-comprehension tests and on the vocabulary sections of intelligence tests is substantial. With a diverse group of adolescents and adults, the coefficients of correlation were .45, .37, and .44 for freely-written responses, objective-type scores, and total comprehension, respectively. The average reading scores definitely increased from the lowest to the highest quartile on intelligence as indicated by the vocabulary section of the Binet test, Form L.[4]

A preliminary study[5] of the relationship between the Stanford-Binet I.Q., Form L, and the reading test in that form (64 cases) showed a wide range of responses on the reading test within the mental-age range of 6–2 to 8–10, inclusive: time of reading from 25 seconds to 2 minutes, 49 seconds; number of errors from 0 to 24; memories from 0 to 19.

In the narrower mental-age range of 7–0 to 7–10, inclusive, and I.Q. range of 57 to 100, many types of reading ability were indicated by the reading test—the slow, accurate reader; the slow, careless reader; the fast, accurate pronouncer of words without much attention to content; and the fast reader with good comprehension. This preliminary study suggests that reading performance may vary greatly within a narrow mental age range. Obviously, a single correlation between total intelligence score and reading score does not tell the whole complicated story of the relations between general mental ability and different types of reading ability.

Relation between Individual Growth Curves of Intelligence and Reading

The relation of differences in intelligence to reading development is most interestingly portrayed by individual growth curves. Millard[6] found reading achievements of children

[4] Strang, Ruth. *Exploration in Reading Patterns.* p. 114. Chicago: The University of Chicago Press, 1942.

[5] Made by the writer with the assistance of Miss Georgia Lightfoot.

[6] Millard, Cecil V. "The Nature and Character of Pre-Adolescent Growth in Reading Achievement." *Child Development,* XI (1940), 71–105.

of every age from 7 to 11 in the upper intelligence groups superior to achievements of those of lower intelligence. "The more intelligent children, both boys and girls, are growing toward higher maxima, and begin and end their reading developments at earlier ages than the lower groups. On the other hand, rates of growth are nearly equal and the times required for developments are approximately the same."[7] In other words, the reading curve of boys with an average I.Q. of 111.0 is higher than, but runs parallel to the lower reading curve of boys with an average I.Q. of 97.0. The same thing is true for the two groups of girls, average I.Q.'s 119.8 and 101.0, respectively. Thus the I.Q. seemed to be a potent factor in determining reading performance at a given time and also the maxima toward which a child is growing.

Relation between Growth in Reading and the Total Growth of the Child

Developmental or longitudinal studies have emphasized "reading as a function of the total growth of the child."[8] Olson reported individual cases in which reading development at first lagged behind mental age and "organismic age," but later, through a stimulating environment, special instruction, improvement in health, and general development, took its rightful place as an aspect of the child's total growth.

Implications for Guidance

Research in this area has important implications for guidance, among which are the following:

1. A verbal test of intelligence may give a misleading estimate of the mental ability of an individual who is seriously retarded in reading and language ability.

2. Because group intelligence tests and reading-comprehension tests have so much in common, a reading test may be used

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[7] *Ibid.*, p. 95.

[8] Olson, Willard C. "Reading as a Function of the Total Growth of the Child." *Reading and Pupil Development*, pp. 233–237. Supplementary Educational Monographs, No. 51. Chicago: The University of Chicago Press, 1940.

in educational guidance, especially in talking with parents. It is frequently easier for a parent to understand that his child is handicapped with respect to academic achievement by poor reading ability than it is for him to understand the significance of the mysterious I.Q.

3. As reading ability is related to mental growth and to the total growth of the child, miracles of improvement from remedial-reading instruction should not be expected. An adequate diagnosis should show discrepancies between reading achievement at a given level and the other growth tendencies and, on this basis, realistic expectations can be entertained. Knowing the probable maxima toward which a child is growing and conditions in the environment or in his physical make-up that may be retarding reading development, the counselor can give fairly accurate assurance of improvement following a program of remedial reading which takes these conditions into account.

TEST REPORTS IN EDUCATIONAL COUNSELING

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ONE of the problems of higher education is to induce the student to plan his educational program. The prescribed curriculum solves this problem for the student, but does so at a price which most institutions are unwilling to pay. Electives force choices, and the danger is that selection of courses be on a superficial basis. The social distractions of college life and the hesitation of the immature to make decisions bring many a student to registration day without preparation for decisions which are often important.

Dr. Charles Eliot once expressed his willingness to help any student plan a course of study, but such a comment only avoids the real problem. Motivation for the student and time for the counselor in dealing with many students must be provided. Willingness to help is one thing, and the actual help given is quite another.

Orientation lectures and group guidance often contribute to this problem. In these opportunities some students may find all the help which they need. Registration day also brings conferences with members of the faculty, and some students may find this adequate. The hurried planning on registration day is usually in terms of immediate choices, however, rather than in terms of a complete course of study. The personnel officers and faculty members of the college often discuss with the student his total program of studies. When this is done, the academic plans are likely to be more adequate. The student by consideration of the reasons for his selections also tends to develop a sense of goal. Increasingly, the study of course programs should become a "taken-for-granted" part of the college experience.

Students do not always covet such an opportunity. Many reasons might be suggested for this reluctance, but they all involve the lack of appeal which such a conference holds. On some campuses, it is not expected. Where encouraged, students must have a manageable approach and the assurance of cooperation from an adviser. The anticipated result must be meaningful to the student. These conferences are learning situations which require the active participation of the student. It is best when the initiative is taken by the student rather than by the personnel officer.

One of the best introductions to these problems is in the report to the individual student of the results of the college testing program. Where a battery of tests is administered to entering freshmen, a report of the results to individual students upon request offers opportunities of importance in the planning of college work.

This method should not be confused with the report of intelligence quotients to students. The question of the wisdom of making this report might be supplanted by the question of the possibility of making it. The student may hear the number, but be entirely unable to perceive the meaning. Emotional coloring may be the primary result. At best, the I.Q. does not condense the complexities of personality into a single number.

It is quite another matter to interpret a battery of tests in the light of all available information from the past and of plans for the future.

An adequate battery of orientation tests includes one or two group tests of academic aptitude. It is better to use two such tests in order to provide a check for individual results. A reading test is included, since so many students lack adequate skills in reading and study. Achievement tests in the fundamental areas, English, social studies, natural science, and mathematics, are valuable both to the college and to the individual student. An inventory in the general field of personality may be serviceable, although the use of this instrument as a part of the orientation test battery is subject to some question.

Students may not relish the opportunity of taking such a battery of tests, although explanation of the values brings co-operation. After they have taken such a test series, however, students do want to know the results. For some, this is largely curiosity, asking nothing more than an interesting item for the letter home. Others desire only to know "what my I.Q. is," and this question must be revised before it is answered. Other students have a conviction that their levels of ability are far above their past accomplishments, and they may want to have this self-confidence verified. Other students come with a surprisingly adequate conception of the possible service of such a test battery.

Some students do not want to know the results. Some are afraid that the information would be discouraging and wish to avoid the issue. Some are indifferent about the results. Some are prepared to respond soon after the test battery has been administered, but lose that interest after a few weeks.

In one group of 256 eligible freshmen, 207 requested an interpretation of freshmen orientation tests. In eight other cases, initiative was shared by the students and the personnel office. Of the 41 students who made no approach, some dropped out of school during the first semester, a few could not be accommodated at the time of request, and some were apparently not interested. This represents a response of more than 80% of the eligible group, however.

In a second group of 307 eligible freshmen, 181 responded during the freshman year, and 24 during the first semester of the sophomore year. Some 15 others of the group requested an appointment, but, when they could not be accommodated within a reasonable period of time, made no further approach. The students who made no request included a disproportionate share of weaker students.

In other groups with which the writer has used this method, totalling some twelve hundred freshmen, more than two-thirds have at their own initiative made appointments to review the test results. The majority of these requests came during the first semester, beginning as soon as the tests were scored. Other periods of frequent requests followed reports of grades

(mid-semester and semester), or preceded the close of school in the spring. When students are ready to plan their academic work seriously, they frequently request a report of test results.

This report is given upon the background of the total experience of the student. The whole cumulative record is consulted, and further information is offered by the student himself. Such topics as high-school grades, study habits, reading skills, cultural interests, ratings, time schedules, effort, vocational experiences, vocational plans, social development, and academic plans are included as they seem relevant.

The conferences are not identical. The student has taken the initiative in making the appointment, and he is expected to guide much of the conference. His desire to know the results of the tests is satisfied in a frank interpretation of results. When the result is unfavorable, stress is placed upon any positive factors present, but the report is nevertheless given as promised. Related areas are included as the test scores are reported, guided by the point of reference which seems meaningful to the student. In this way test results take their place among the common-sense factors in analysis and planning.

The conference is not limited, however, by the felt needs of the student. It may proceed to topics which the student had not regarded as important in his problem. The contribution of the adviser is natural, and may be central when the conference seeks potentialities or background.

One area is not accented. The inventory of personality traits is reported only briefly. Opportunity for later conferences in this field may be mentioned, but the test report omits any detailed discussion. This habit avoids the very real danger of invading the student's right to privacy. There is, on the other hand, the danger of missing an opportunity to assist a student whose problems are in the field of mental hygiene. The latter risk seems preferable to the former. Many students can readily be led to speak very frankly during such a conference; some advisers regard this as the mark of success; it seems wiser to use restraint. The student may regret his frankness later, and the total results in terms of mental hygiene may be

unfavorable. Where serious problems are apparent, other methods hold better promise.

These conferences often lead to further study by the student. He may, upon discovery of a reading disability, accept opportunities for training. He may seek conferences with teachers in various departments of the institution. There may be a new approach to a social problem. He may require a vocational analysis with further tests of aptitude and interest, and arrangements are made to provide this service. He may lack information about some vocation, and he is referred to librarians or others who have the data. There may be need for further conferences, and these are arranged. Such follow-up by the student is one evidence of the significance of the conference.

Colleges are often criticized for giving tests which are never used. The report to the individual student concerning results opens the whole field of educational counseling. It begins where many students find interest, and it leads to consideration of the whole college experience. Systematic reporting of test batteries can take its place as a major method of the personnel office.

The administrative problem is one of time and budget. Individual conferences require from forty minutes to an hour each. This service cannot be offered unless the administration is willing to supply a sufficient number of trained counselors for reasonably adequate reports and for the subsequent services which are often found desirable.

Evidences of value to the student are found in comments which often seem too discriminating for simple courtesy, in continued student response, in follow-up along lines suggested in conference. Some interviews seem to have little result. Experiments using control groups are difficult on a campus which has developed a tradition of test reports, since the control group must be refused an announced service.

The fundamental evaluation of this method rests upon the assumption that careful planning of educational programs is a significant college experience. This is accomplished to the extent that the student in his more thoughtful moments and the counselor can find wisdom.

THE PERPLEXITIES OF COLLEGE FRESHMEN

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THE *Problem Check List, College Form,* by Ross L. Mooney, was used in the freshman orientation classes at Colorado State College of Education during the Fall quarter of 1942. The check lists were administered twice, in October and December, in each of the five orientation classes. During the interim, the faculty advisors, who were also instructors for the orientation classes, had an opportunity to examine the lists of problems and have conferences with the students in an attempt to help each one individually to solve his own problems.

The *Adjustment Inventory* by Hugh M. Bell, which measures some of the same areas of adjustment as are covered by the *Problem Check List,* was administered to the same group of freshman students. This makes possible a comparison of the results of the two measuring devices, as well as a check on their validity. Other data such as standardized test scores and college grades reflect on the problems listed under ACW (Adjustment to College Work) in the *Problem Check List.*

There are 330 items in the *Problem Check List,* divided equally into eleven areas which are designated as follows:

1. Health and Physical Development (HPD)
2. Finances, Living Conditions, and Employment (FLE)
3. Social and Recreational Activities (SRA)
4. Social-Psychological Relations (SPR)
5. Personal-Psychological Relations (PPR)
6. Courtship, Sex, and Marriage (CSM)
7. Home and Family (HF)
8. Morals and Religion (MR)
9. Adjustment to College Work (ACW)
10. The Future: Vocational and Educational (FVE)
11. Curriculum and Teaching Procedures (CTP)

Out of the five orientation classes there were 190 students who filled in the list both in October and December. The data obtained from these 190 freshman students are used for this study.

1. *Most Frequent Problems*

The problems most frequently checked were those having to do with Adjustment to College Work (ACW). Those troubling the students least often were those concerned with Morals and Religion (MR) and Curriculum and Teaching Procedures (CTP). None of the thirty-five most frequently checked were in the area of CSM (Courtship, Sex, and Marriage), HF (Home and Family), MR (Morals and Religion), or CTP (Curriculum and Teaching Procedures). It can readily be seen why entering freshmen would not have many problems in CTP, but it is a question whether the students do not actually have perplexities in the other areas or whether they do not want to discuss them with the faculty members and, therefore, did not check them.

The following tabulation shows the per cent of the total number of items checked which fall in each area:

Area	*Per cent*	*Area*	*Per cent*
ACW	20.62	FLE	7.45
PPR	14.74	CSM	4.83
SRA	11.98	HF	4.19
SPR	10.72	CTP	3.28
HPD	9.76	MR	3.25
FVE	9.18		

There were four items which were checked by at least one-fourth of the students in October and December: "Wanting a more pleasing personality" was checked by thirty-one per cent of the students, "Worried by examinations" by twenty-nine per cent, "Slow in mathematics" by twenty-six per cent, and "Don't know how to study effectively" by twenty-five per cent.

2. *The Problems of the Entering Freshmen and Those of the Freshman Students at the End of Their First Quarter in College*

A comparison of the number of items checked in each of the eleven areas by entering freshmen in October, about ten

days after the opening of school, and of the number checked by the same students in December, ten weeks later, is made in Table 1.

TABLE 1

Comparison of the Number of Items Checked in October and in December by Freshman Students

Area	October	December	Diff.	% change
ACW	804	516	288	36
SPA	414	272	142	34
MR	122	86	36	30
HF	155	113	42	27
HPD	354	271	83	23
PPR	532	412	120	23
FVE	330	258	72	22
CSM	173	136	37	21
SRA	415	352	63	15
FLE	254	223	31	12
CTP	87	123	−36	−41
Total	3640	2762	878	24

This table is so constructed that the area in which there is the greatest decrease in the number of problems checked appears at the top. The other areas are listed according to the per cent of change occurring. In ten areas there were fewer problems indicated in December than in October. However, in one area, CTP (Curriculum and Teaching Procedures), the number of problems increases. This would be expected be-

TABLE 2

Problems which Occurred Frequently in October and Seldom in December Arranged According to the Size of the Differences Between These Frequencies

Item No.	Item	Oct.	Dec.	Diff.
44	Don't know how to study effectively	77	18	59
256	Trouble in using the library	53	4	49
264	Trouble in outlining or note-taking	51	4	47
243	Lacking self-confidence	62	27	35
70	Unskilled in conversation	61	29	32
263	Unable to concentrate well	56	25	31
237	Lacking in leadership ability	38	12	26
316	Afraid to speak up in classroom discussions	51	25	26
206	Slow in mathematics	61	36	25
15	Being ill at ease at social affairs	41	17	24
241	Afraid of making mistakes	48	24	24
319	Weak in spelling or grammar	45	22	23
236	Wanting a more pleasing personality	69	47	22
14	Wanting to learn how to entertain	28	9	19
238	Too easily led by other people	27	8	19

cause when the first check list was given the students had very little contact with college classes or curriculum problems. On the scale as a whole, there was a decrease of 24 per cent in the number of problems checked.

The list of problems in Table 2, those which were prevalent in October but which had been solved by many students by December, indicates that the orientation program was quite effective in teaching the freshmen how to study and in helping them gain self-confidence. Many of the problems occurring more frequently toward the end of the quarter, (see Table 3)

TABLE 3

Problems which Occurred Frequently in December and Seldom in October

Item No.	Item	Oct.	Dec.	Diff.
96	Getting low grades	24	44	20
226	Tired of same meals all the time	7	23	16
100	Wanting to leave college	0	12	12
5	Not enough sleep	23	34	11
11	Not enough time for recreation	8	19	11
235	Too little chance to go to shows	4	15	11
329	Grades unfair as measure of ability	0	11	11
42	Purpose in going to college not clear	7	16	9
52	Dull classes	1	10	9
232	Too little time for sports	9	18	9
234	Too little chance to listen to the radio	10	19	9
290	Too little chance to read what I like	17	26	9
209	Not smart enough in scholastic ways	14	22	8
190	Not taking things seriously enough	11	18	7

reflected unrest and irritation of a more individual and personal nature: perhaps a general lack of security and consequent maladjustment due to war times.

3. *Differences Between the Problems of the Men and the Women*

In October the freshman women checked, on the average, 20.8 problems each and in December 15.8 problems each, a decrease of 5.0 problems. The corresponding figures for the men are 15.4, 11.6, and 3.8.

The most frequently checked problems are listed in Tables 4, 5, 6, and 7. There were six problems which were checked by over 20 per cent of the girls both in October and December, evidently showing a genuine concern over these matters. These

TABLE 4

The Problems Most Frequently Checked by 132 Freshman Women in October, 1942

Item No.	Area	Item	No.	%
44	ACW	Don't know how to study effectively	60	45.45
236	SPR	Wanting a more pleasing personality	58	43.94
243	PPR	Lacking self-confidence	49	37.12
206	ACW	Slow in mathematics	48	36.38
70	SRA	Unskilled in conversation	46	34.85
261	ACW	Worrying about examinations	45	34.09
264	ACW	Trouble in outlining or note-taking	44	33.33
263	ACW	Unable to concentrate well	44	33.33
317	ACW	Vocabulary too limited	44	33.33
316	ACW	Afraid to speak up in class discussions	43	32.58
265	ACW	Trouble in using the library	43	32.58
210	ACW	Unable to express myself in words	39	29.55
241	PPR	Afraid of making mistakes	39	29.55
76	PPR	Moodiness, having the "blues"	38	28.79
22	PPR	Taking things too seriously	37	28.03
156	FVE	Wondering if I'll be successful in life	33	25.00
237	SPR	Lacking leadership ability	32	24.24
15	SRA	Being ill at ease at social affairs	32	24.24
23	PPR	Nervousness	30	22.73
97	ACW	Fearing failure in college	29	21.97
20	SPR	Feelings too easily hurt	29	21.97
47	FVE	Doubting wisdom of my vocational choice .	28	21.21
319	ACW	Weak in spelling or grammar	28	21.21
112	HPD	Poor complexion	27	20.45
79	PPR	Too easily discouraged	27	20.45

six problems, except in one or two cases, have to do with personal and social adjustment. There is only one problem which specifically deals with the educational side of college life. This problem is "Worrying about examinations." This same item ranks rather high with the men but does not occur so frequently among them as it does with the women. The paramount problem with the men seems to be "Concerned about military ser-

TABLE 5

The Problems Most Frequently Checked by 132 Freshman Women in December, 1942

Item No.	Area	Item	No.	%
261	ACW	Worrying about examinations	50	37.88
236	SPR	Wanting a more pleasing personality	39	29.55
96	ACW	Getting low grades	33	25.00
317	ACW	Vocabulary too limited	32	24.24
76	PPR	Moodiness, having the "blues"	32	24.24
20	SPR	Feelings too easily hurt	30	22.73
22	PPR	Taking things too seriously	29	21.97

TABLE 6

The Problems Most Frequently Checked by 58 Freshman Men in October, 1942

Item No.	Area	Item	No.	%
160	FVE	Concerned about military service	32	55.17
44	ACW	Don't know how to study effectively	17	29.31
319	ACW	Weak in spelling or grammar	17	29.31
70	SRA	Unskilled in conversation	15	25.86
243	PPR	Lacking self-confidence	13	22.41
22	PPR	Taking things too seriously	13	22.41
206	ACW	Slow in mathematics	13	22.41
10	FLE	Needing a part-time job now	12	20.67
263	ACW	Unable to concentrate well	12	20.67

vice." This is the only problem which 20 per cent or more of the men checked in both October and December.

These data would indicate that if student needs are to be adequately met, it might be wise to have a differentiated orientation course for men and women, or at least give some special help to the girls in matters of personal and social adjustment.

4. *Relationship Between the Number of Problems Checked on the Mooney* Problem Check List *and the Scores Made by the Same Students on the* Bell Adjustment Inventory

There are four different phases measured by the *Bell Adjustment Inventory*. These same phases of adjustment also appear in the *Problem Check List*. If these phases are adequately measured by the two tests then there should be a high correlation between the scores made on the corresponding parts of the two tests. The correlations, computed from the data obtained in October, are given in Table 8. Four out of the six correlations are fairly high for this type of data, measures of

TABLE 7

The Problems Most Frequently Checked by 58 Freshman Men in December, 1942

Item No.	Area	Item	No.	%
160	FVE	Concerned about military service	33	56.90
170	HPD	Weak eyes	13	22.41
5	HPD	Not enough sleep	13	22.41

TABLE 8

Correlations between the Number of Problems Checked in the Various Areas in the Mooney Problem Check List *and the Scores Made in Similar Measures of Adjustment in the* Bell Adjustment Inventory *by 186 First-Quarter Freshmen*

Problem Check List	Bell Adjustment Inventory	r	PE_r
Area	Measure of adjustment		
HPD	b. Health	.562	.034
SRA	c. Social	.538	.035
SPR	c. Social	.376	.042
PPR	d. Emotional	.511	.036
CSM	d. Emotional	.388	.042
HF	a. Home	.495	.037

personality traits. However, there is a possibility that they are spuriously high as a student who checks many items on one test may also check many on another, regardless of the area. To determine this, inter-correlations should be computed between all of the areas on the *Check List* and all of the measures of the *Adjustment Inventory*.

5. *The Effect of Adjustment to College Life on Grades*

The data in Table 9 were collected at the close of the Fall

TABLE 9

Intercorrelations and Partial Correlations, with their Probable Errors, between Grades, Intelligence, and Adjustment to College Work

	Fall quarter Grades (2)	A.C.E. Psych. Exam. %iles (3)
I. Zero-Order Correlations		
ACW (1)	$-.288 \pm .045$	$-.156 \pm .048$
Fall Quarter Grades (2)	.....	$.531 \pm .035$
II. Partial Correlations		
$r_{12.3}$	$-.245 \pm .047$	.....
$r_{13.2}$	$-.004 \pm .050$	.....
$r_{23.1}$	$.513 \pm .037$	.....

quarter, 1942, for 184 freshman students. The grade average was for one quarter. The *American Council on Education Psychological Examination* was taken at the beginning of the

Fall quarter when these students entered college. The problems in ACW (Adjustment to College Work) were those checked by these students in December.

There is a very low negative relationship between the number of problems checked and both grades and intelligence test scores. This indicates a slight tendency for the poorer students to have more problems. In the second part of the table are listed the partial correlations. For example, $r_{12.3}$ shows the relationship between adjustment to college work and grades with intelligence partialled out or with intelligence held constant. This is a low negative relationship. The partial correlations are changed only slightly from the corresponding zero-order correlations. There is no relationship between intelligence and adjustment to college work, and a low negative relationship between grades and adjustment to college work.

6. *Conclusions*

After the Mooney *Problem Check List* was "tried out" in the freshman orientation classes at Colorado State College of Education in the fall of 1942, the instructors of the classes and other members of the Personnel Department expressed themselves as favoring the use of this check list because:

1. It is not a test; students are not ranked or graded in any way.
2. Psychological terms for describing personality, such as introversion, maladjustment, dominance, etc., which are not well understood by many faculty advisors and most students, do not appear in this check list.
3. The results of this list furnish basic information which can be used in strengthening an orientation course. Those areas in which many and vital problems occur, may well be considered in organizing an orientation program.
4. A student's check list furnishes a point of contact valuable in individual conferences.
5. The results of the *Check List* are considered as temporary remediable problems and not part of the student's permanent record.

From the results of the present study it was found that the

problems checked were not equally divided among the eleven areas. The largest number, over 20 per cent, were in the "Adjustment to College Work," while only about three per cent were in the area of "Morals and Religion." This is in accord with the emphasis placed on these subjects in the orientation course. As may be expected, there were more problems apparent in "Curriculum and Teaching Procedures" after two months of college attendance than there were at college entrance. Of the problems which occurred frequently in October and seldom in December, the three showing the greatest reduction were all of them topics of discussion in the orientation classes. Many of the problems occurring frequently in December and seldom in October were the outcome of having experienced college itself. However, such items as "tired of the same meals all of the time" could be taken up with the proper authorities and the condition removed without embarrassment on the part of any student.

The results of the *Problem Check List* show a definite relationship to scores made on the *Bell Adjustment Inventory* when similar areas are compared.

Correlations with grades show a tendency for those who make the lower grades to have more problems in adjusting to college work (ACW).

In general the *Problem Check List* has proved to be a valuable tool in the freshman counseling program at Colorado State College of Education.

A NOTE ON MARKING PROCEDURES

H. M. COX
The University of Nebraska

COMMON classification examinations and common final examinations were introduced into courses of freshman mathematics and freshman English at the University of Nebraska before any thought was given to their use as a basis for marking in terms of the course rather than in terms of the instructor or section. There was no general agreement among instructors in the interpretation of scores on the final examination save, perhaps, in setting critical levels for *passing* or *failing*. However, studies of the examinations revealed their adequacy for use in determining the marks both of individuals and groups.[1] In consequence, the Department of Mathematics and the teachers of courses in freshman English took action to use more extensively the results from common, final examinations. The Department of Mathematics resolved that:

> The average (mean) final semester mark given to students who pass in a section of a mathematics course may not vary by more than two points from the average (mean) mark made by these students on a common, final examination.[2]

In the Department of English, the teachers charged with instruction in freshman courses have followed a somewhat more detailed procedure. The final examination given at the end of the first semester consists of two parts: first, an examination comparable to the test which is given for classification pur-

[1] Cox, H. M. "Pre-Study Examinations in Mathematics." *National Mathematics Magazine*, XVII (1943), 351–359.
Cox, H. M. and Harsh, C. M. "Sub-Correlation in Course Marking." *The Journal of Educational Psychology*, XXXIII (1942), 379–384.

[2] It is to be noted that although agreement is thus obtained in central tendency, no control is exercised on the variability of the distribution of marks. Nor is provision made to extend the comparability of marks in the different courses for which the subject matter may be sequential or parallel.

poses;[3] second, a theme which is rated on a half dozen categories and marked on a scale made equivalent to that of the uniform examination. The uniform examination consists of questions predicated upon the skills and techniques of English composition; the theme ratings are intended to measure some of the more intangible objectives of the course. The procedure for obtaining a final mark requires that each teacher make use of the distribution of examination marks for a section (as obtained from the application of a scale to the examination scores) to serve as a guide in assigning marks to the theme written at the end of the course.[4] The distribution of examination marks is also used as a guide in expressing the daily-quiz average accumulated over the semester. The three marks (examination, theme, daily average), which have thus been reduced to a common denominator, are added together and a rank order of the students obtained. To this rank order of students the distribution of examination marks is again applied so that the picture is that the distribution of final, semester marks is approximately the same as the distribution of marks on the uniform examination. In this manner, a reconcilement is effected between the varying standards which obtain in the minds of individual teachers.

It is to be remarked that within the English and mathematics courses scores on the final examination are used singly to furnish a rating on student achievement and collectively to furnish a distribution of final marks for each section. The two operations should be thought of as separate processes for the reason that a final mark of a particular student is in no wise fixed by the examination alone. The examination score is used in combination with the daily-quiz average and such other ratings as a particular course may afford. Thus the stage is set throughout the semester for the individual instructor to develop the subject matter in the manner in which he chooses. The procedures used in obtaining the final semester mark simply require that the instructor withhold exact evalua-

[3] Cox, H. M. "A Program of Instructional Research and Student Guidance." *Journal of the American Association of Collegiate Registrars*, XVII (1942), 295–304.

[4] The method for grading themes is given in an appendix.

tion of quiz scores until, from comprehensive examinations, he can determine the mean level of ability of his students as compared with those in other sections.

APPENDIX

Method for Grading Themes

1. Read themes and classify in broad categories in order of quality.
2. Reread themes within each category and assign approximate rank order to the themes in each category.
3. Stack themes in descending rank order.
4. Count themes from the top of the stack until the predetermined number of A's is reached, then continue until the expected number of B's is reached, and so on. Theme grades need not necessarily follow these divisions, but adjustments should be made in the following manner:
   a. Reread themes around arbitrary division points between A, B, etc. Place each theme in the group in which it best fits.
   b. Marginal notations and the customary rubrics will aid materially in, and may substitute for, the 2nd and 3rd readings.
   c. More latitude should be used on themes written during the course (shifts should generally be *down* rather than *up*); more strict adherence to method should be followed with themes written as a part of final examination.
5. Predetermined number of A's, B's, C's to be expected should be got from objective departmental examinations, viz., placement, final, etc. in the following manner:
   a. From the total distribution of scores for a large group, the range of scores equivalent to marks of A, B, C, D, and F should be determined and corresponding marks should be assigned to all students.
   b. In any section or group the number of A-students, B-students, etc., can be determined. These *numbers* of A's, B's, etc., are logically to be expected in the distribution of theme marks. This does *not* mean that the same individuals making A in the objective test are expected also to make A in the theme score.

NEWS NOTES*

Officers of the American College Personnel Association for the year 1943–1944 are as follows:

President, E. G. WILLIAMSON
Vice President, C. GILBERT WRENN
Secretary, D. D. FEDER
Treasurer, WILLARD BLAESSER

Members-at-Large of the Executive Council

JOHN G. DARLEY
HELEN FISK
GRACE MANSON
THELMA MILLS
HELEN VOORHEES

The Council of Guidance and Personnel Associations held a work meeting of the officers, trustees and chairmen of standing committees of its member organizations at the Hotel Biltmore, New York, on November 18, 1943. The representatives of the individual organizations held business meetings on November 17, 19, and 20. The planning committee on which we were represented by Helen Voorhees organized the program around the two major topics of "Rehabilitation Problems on the Home Front" and "Preservation of Social Values in a Time of War."

N. J. Aiken, Director of Placement at the State College of Washington, has had Lee J. Cronbach, Assistant Professor of Psychology, send us a copy of an extensive annotated bibliography of "Manpower Psychology" which he prepared. The bibliography lists and describes 147 articles, chosen from those published between 1931 and 1943. Topics included are job satisfaction and motivation, grievances and labor relations, leadership and group morale, handling personality problems, selection and rating, womanpower, training, and environmental and psychological influences. Mimeographed copies of the bibliography may be secured from the author.

Wilma T. Donahue, Psychological Clinic, University of Michigan, gives the following brief description of an Aptitude Testing Program carried out at the University of Michigan in April and May, 1943:

> The University War Board received a request from a group of students soon after war was declared for an aptitude testing program which would help them determine their fitness for engineering. They felt that engineering was a very important field in relation to the war effort and believed that scientific methods should be brought to bear on the selection of students to study in that field. The University War Board accordingly brought the request to the attention of the University officials, who, in turn, arranged a testing program through the Office of Educational Investigations. The function of this testing program was not only to determine those students who might be expected to succeed in engineering, but to help other students to find the field in which they might make the greatest contribution in the war and post-war periods.

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* News items concerning members of the American College Personnel Association should be sent to Grace E. Manson, Northwestern University, Evanston, Illinois.

A battery of seven tests and a personal questionnaire were administered to 2,126 students (1,554 girls and 572 boys) distributed about equally in the freshman, sophomore, and junior classes of the University. The battery of tests included a general scholastic aptitude test, achievement tests in English, mathematics and general science, and aptitude tests in constructive visual imagination, mechanical comprehension, and clerical aptitude. The tests scores were broken down into seventeen variables, which were reported to the student as standard scores which he could plot in the form of a profile on a graph provided for the purpose. Thus the student was able not only to determine his position in the group but to compare his aptitudes and achievements in the various fields tested.

A group of skilled vocational counselors were available for personal consultation with those students who wished to discuss their test results. A gratifying number were eager to avail themselves of this privilege. The students were also urged to discuss their test results with their families and with their academic counselors. Further, a great many of them were referred to designated counselors in special war-time programs on the campus or in those fields most closely related with the war effort.

J. Julius Flood, Personnel Director at Tuskegee Institute, reports that over six hundred students and graduates have entered the various branches of the armed services. A number of both the men and women have received commissions. In addition to his guidance program, Mr. Flood has been instructing in academic courses for men of the 320th college training detachment who are stationed at the Institute.

Forrest H. Kirkpatrick, long-time Dean of Students at Bethany College (W. Va.), continues on leave of absence and is serving the Radio Corporation of America in the field of personnel planning and research. His work includes the development of procedures, policies, and organizational structure for personnel administration in the several manufacturing plants and distribution centers.

Corinne G. LaBarre, Research Assistant, Western Personnel Service, attended the Southern Pacific Area Hazen Conference on Student Guidance and Counseling held August 5–12, at the San Rafael Military Academy, San Rafael, California. A group of sixty counselors, deans of women, and other academic personnel were present. Mrs. Grace Loucks Eliott, newly appointed general director of the National Y. W. C. A., led discussions in areas related to student life, such as race issues, world citizenship, vocations, economic security, marriage, and family life. Helen Moreland, Dean of Women at the University of Southern California, was chairman of the conference.

Ineva R. Meyer is on leave of absence from her position as Dean of Freshmen Women at the University of Wisconsin and is a Lieutenant (s.g.) in the Spars stationed at headquarters in Washington, D. C.

Herbert W. Saul, formerly Director of Guidance at the Boston Y. M. C. A., has returned to industrial personnel work and is now with the Merrimac Division of the Monsanto Chemical Company in Everett, Massachusetts.

Frances M. Tallmadge, formerly Assistant Dean of Students at Antioch College, is now on the staff of the Radio Corporation of America in the personnel planning and research department. She is in charge of the Engineering Cadette Program at Purdue University.

Beginning with the fall quarter of 1943, the University of Minnesota will require a speech examination of new students in the freshman class. This examination will

be conducted by the Speech Clinic, a division of the Office of the Dean of Students. Dr. Bryng Bryngelson is Director of the clinic and E. G. Williamson is Dean of Students. For a number of years certain colleges in the University have required a similar examination of new students. These colleges included Education and Nursing. Experiences with students in these colleges indicated the desirability of early identification of speech disability in order that clinical remediation might be undertaken before students with serious disabilities have progressed in their professional training. Under the new program, some students may be advised to undertake clinical retraining, others will be enrolled in speech classes, and still others with serious disabilities will be referred to the Student Counseling Bureau (formerly the Testing Bureau) for vocational guidance and the selection of a type of training for which their speech habits will be a less serious impediment. Reports of the speech examinations will be made to advisers, counselors and administrators.

A special feature of the clinic's program involves cooperation with the newly formed Students Activities Bureau in the use of speech remediation as an important part of a comprehensive program of social adjustment counseling through participation in extra-curricular activities. Speech habits are recognized as an important factor in effective emotional and social adjustment.

The University of Iowa has established a Committee on Examinations to study and prepare recommendations concerning examination practices on the campus and has put in operation a related University Examinations Service to assume for instructors the mechanical and clerical burdens involved in testing and to provide technical advice and assistance upon request.

For the present, the Committee on Examinations will concern itself primarily with problems related to the war effort. The committee will consider the problems of granting sound credit for military experience to students enrolling after discharge or demobilization from the armed forces and of determining the proper educational placement of such students. Among the immediate problems dealt with by the committee will be those of developing examinations and examination procedures for the specialized military training programs on the campus.

The members of the Committee on Examinations appointed by President Mancher are Professors Baird, H. Barnes, Kurtz, McCarty, Mallett, Oberg, Spence, Tyndall, and Lindquist. Professor Lindquist, who is chairman of the committee, and Paul Blommers, its secretary, also serve as advisors on examination problems for the University Examinations Service.

Technical assistance in the construction, administration, and interpretation of examinations of all types will be available to instructors through the University Examinations Service. The Examinations Office is making a collection of sample copies of available examinations constructed at other colleges and universities, and of other standardized and published examinations designed for use at the college level. Mechanical and clerical services available to instructors through the Examinations Office include the duplicating and scoring of examinations, the transmutation of raw scores, and the calculation of basic statistical measures. More specialized statistical analyses of particular examinations will be conducted as needed. Further specific services may, upon the recommendation of the Committee on Examinations, be provided by the University Examinations Service.